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CLINIC OF DR. GEORGE DOCK

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FOCAL INFECTION AND ARTHRITIS

THIS subject is now in a period of reaction from the enthusiasm that met the early contributions—a reaction that is effective not only in current medical literature but also in medical practice. Such reactions are characteristic of therapeutics, but are none the less unfortunate. In the case of focal infections the present situation seems especially unfortunate for several reasons. The etiology and pathology of focal infections as well as their possible results are still very obscure, and the investigations so enthusiastically begun must suffer from the limitation of material. Much clinical and anatomic research is necessary, but the eloquent voices and facile pens that take the so-called conservative view seem to imply that all is known. Yet one phase, the disposition of arthritis on the one hand, the immunity to it on the other, as shown by various subjects, is one of the great puzzles of medicine. The equally puzzling tendency of some arthritics to ultimate recovery, with more or less deformity and loss of function in many cases, as contrasted with the resistance of others to all known methods of treatment, is quite as remarkable.

As in many other therapeutic problems the patient's side is seriously misrepresented. Much has been said about the removal of tonsils and teeth that should not have been removed. No one can defend the extirpation of any organ or tissue not known to be diseased, but in the case of diseased organs, like certain teeth or tonsils, even should the operation be without

benefit on the coexisting arthritis, the patient does not lose something useful or necessary, but gets rid of something that has many sources of danger other than the one suspected of relation with an arthritis. In the case of teeth especially is there a great and baseless condemnation. Severe pyorrheas and apical abscesses can be healed by skilful treatment, but how rarely are they. Few dentists are prepared to do the work; fewer patients have the time, money, and perseverance necessary for a course of treatment and its frequent repetition. The result is continued infection and imperfect mastication, both of which are dangerous, and although the final results may be remote, they may appear with unexpected suddenness and severity. Moreover, although we occasionally see patients who have trouble with their artificial teeth, we can find many others who have used plates, sometimes complete, for forty or fifty years or more, and who show a remarkable digestion and nutrition as well as a freedom from arthritis as well as some other common infections. This is not an argument for indiscriminate extraction of teeth, but a consolation for those who need extraction.

In the study of clinical therapeutics two ways can be followed. One is to accumulate a large number of case histories having certain features in common and draw conclusions from the outcome. The larger the number, accuracy being secured in as many details as possible, the smaller the error. But this is a slow process. Another way is to make an individual study in each case; to look on each case as a complex experiment and use the results as guides in other experiments, but not to draw dogmatic conclusions. I have long been interested in the treatment or removal of suspected foci of infection in arthritis and other diseases, but for various reasons have not yet felt able to analyze the group as a whole. I wish today to present the cases of two patients who illustrate what I consider useful methods of treatment and favorable possibilities. I have no doubt many will assert that the results here were coincidences; that the patients would ultimately have reached the same states without focal treatment. This I freely admit, but I also believe that all definite diseases, no matter how trifling they seem, should be

treated as thoroughly as possible. If more than local results follow, so much the better, and the question of how or why can easily wait for its answer. I also believe that the measures used were relatively innocuous; that many other cases should follow a similar course; that after such measures have been applied for similar lesions, if symptoms persist, other foci should be searched for, and any that are found should be treated according to the best knowledge and skill available.

One patient had a rather recent arthritis, with some obscure chronic features not easy to name or interpret, but of great practical importance, in which complete recovery occurred. The other was a chronic multiple arthritis in which continued efforts at assistance were followed by very considerable relief of symptoms, with almost complete functional improvement.

CASE I

Diagnosis.—Pyorrhea, apical abscesses; acute arthritis.

E. M., fifty-five years of age; married; white; farmer and banker.

Chief Complaint.—Pain and swelling of left foot with stiffness of big toe joint.

Family history negative.

Previous History.—Usual diseases of childhood, including diphtheria and scarlet fever, without complications. Grew up in malarial section of Illinois and had malaria every summer up to age of fifteen; none since. Was very strong and healthy; no other illness as an adult except typhoid with relapse in 1891. Since then has been well, excluding occasional headache and certain obscure symptoms mentioned later, up to present illness.

Has been accustomed to active out-door life until recent years, when stress of office business has caused a more sedentary life. Smokes and uses alcohol to only slight extent. Appetite always good, bowels regular, sleep normal. No urinary disturbances. No venereal disease.

Marital history unimportant.

Present Illness.—Six weeks before admission, while walking over rough ground, landed heavily on left foot, which soon be-

came red and swollen, with much pain in the first metatarsophalangeal joint. Rest, wet applications, and bandages had little effect. *x*-Ray examination was supposed to rule out traumatic arthritis, and very soon a diagnosis of gout was accepted, based probably partly on English descent and the ability of the patient to live luxuriously. Antigout diet, colchicum, salicylates, cinchophen, hot baths, and mud baths were used for several weeks without definite improvement, but with enough remission at times to keep up trust in the treatment and hope for complete recovery.

Extensive investigations were made for other sources of disease, but with no practical results. Blood-cultures were attempted; the urinary tract was examined and said to be negative, but Staphylococcus albus was cultivated from the prostatic secretions and vaccines made, but not used. Complement fixations were negative with gonococcus and viridans. *x*-Ray films were made from the teeth, much disease found, and extraction recommended, but with the belief in medical treatment the advice was not followed, nor was the obvious indication for disinfection of the mouth even attempted.

For about six weeks the foot had remained about the same, comfortable when quiet, painful when it bore weight, with a prompt return of the redness, pain, and swelling of the entire foot after such trials. At this time the patient was sent to me, with special reference to focal infection and its treatment.

Physical Examination.—Man of large frame; well nourished; looks well; color good. Skin negative. Reflexes normal.

Head.—Negative except as to tonsils and teeth. No tophi. The teeth in very poor condition; the whole upper set in one bridge; the supporting teeth loose, with severe pyorrhea, the pus containing various bacteria, spirochetes, and amebæ. The lower teeth also extensively crowned and bridged and also with severe pyorrhea. Tonsils slightly enlarged, ragged, but without signs of acute inflammation.

Lungs and *heart* negative on physical examination. Blood-pressure 140/70.

Abdomen.—Large; very thick wall. No areas of tenderness;

no masses. Liver, spleen, and kidneys not palpable. Genitalia negative; urine negative.

Extremities.—Upper, negative. Lower, right negative; left, the entire foot is swollen, especially over dorsum and laterally, almost obliterating the external malleolus; soft and boggy and pits deeply on pressure. The metatarsophalangeal articulation of the great toe is moderately enlarged, red, and glossy. Motion (passive) normal, no crepitus; no deposits or localized pain point; motion at ankle unrestricted. There is slight tenderness on pressure at base of great toe.

Blood: Hemoglobin, 98.

R. b. c. = 6,240,000.

W. b. c. = 11,200.

Differential negative (69 per cent. polymorphonuclears); microscopic appearances of red cells normal.

Non-protein nitrogen of blood (Dr. Olmsted) 23 mgm. per 100 c.c. of blood. Uric acid 4 mgm. per 100 c.c. blood (an upper limit of normal).

Wassermann negative. Blood-culture negative.

Dr. W. E. Sauer examined throat and advised tonsillectomy. I agreed with this opinion, and as the teeth required more time, advised that the tonsils be removed at once.

Under local anesthesia both tonsils were removed by Dr. Sauer. No bleeding; rapid recovery. The tonsils as removed were rather small, soft, and purplish; cultures showed Streptococcus viridans.

Dr. Allison examined patient from the orthopedic standpoint and noted marked tenderness of first left metatarsal bone and in the metatarsotarsal joint. The phalangeal joints of the great toe showed tenderness on motion; the radiogram revealed considerable atrophy in tarsal and metatarsal bones, and exostoses on terminal phalanges of both great toes. Dr. Allison gave the opinion that the condition of the left foot was an infectious process arising from both teeth and tonsils. Cast applied and divided; to be kept on except while foot is being baked; the latter to be done twice daily.

For several days after tonsillectomy there was throbbing

pain in left foot and the skin over first metatarsal and first phalanx was redder than before. The symptoms were somewhat relieved by the use of electric light given for two hours each day; at other times foot was kept in cast. Later the foot was strapped with adhesive by Dr. Allison.

After dental consultation, the removal of the bridges and teeth was begun and carried on as rapidly as possible. By the time all the teeth were extracted, three weeks after admission, the foot was free from redness and there was no swelling except after considerable use.

Then the pain returned; the adhesive plaster was removed and baking resumed for one hour daily. By the end of four weeks all signs of inflammation in the foot were gone.

The treatment in this case followed the lines that seemed to me indicated. The tonsils were distinctly diseased. Though less likely as sources of infection than the teeth, they offered favorable foci, and their removal was likely to be easy and healing prompt.

The teeth seemed more likely to be the foci from which the foot was infected. They were obviously dangerous in many other ways. The bridge work had been made by one of the most skilful specialists in his line, and the pyorrhea had been treated constantly for years by himself and another expert and painstaking specialist. The former had been consulted and insisted that the teeth need not be removed; that local treatment would result in healthy roots. Admitting the possibility, the severe and intractable arthritis in the foot indicated more radical treatment, while the teeth would require constant care and might require extraction in spite of that. I therefore urged as complete removal of teeth as dental experts agreed to be necessary. This amounted to complete extraction and upper and lower plates.

Although the genito-urinary tract showed no distinct infection, the patient was nearing prostatic age. He was examined by Dr. J. R. Caulk, who found a slight chronic inflammation with staphylococci. As a possible focus this was treated locally and soon subsided.

The result of the whole treatment was better than expected.

Soon after the tonsils and teeth were removed the foot recovered, having been treated on the same lines it had been before—heat, rest, fixation, but without medication. There has been no arthritis of any kind in the subsequent four years.

But another thing not less striking occurred. Before the focal treatment, for six or seven years, the patient had had occasional and severe attacks with headache, violent toxic gastro-intestinal symptoms, and great prostration. Many experts had failed to advise anything that checked the attacks. Pale optic disks had once led to the suspicion of specific neurovascular disease, but there was no other evidence of that. Since the removal of the foci those attacks have wholly ceased, while the mental and physical energy and endurance of the patient, notwithstanding increased years and cares, have notably increased.

In this case the *post hoc* was prompt and satisfactory. It is often slow and uncertain, as in the following:

CASE II

Diagnosis.—Arthritis, chronic multiple; pyorrhea; tonsillitis, chronic.

S. M., white female aged fifty.

Chief Complaint.—Pain and swelling of fingers and knees.

Family history negative.

Previous Condition.—Does not recall any diseases of childhood. Has always been in excellent health until seventeen years ago, when she had an attack of "bronchitis and asthma." These attacks have continued each winter, less severe in last two years. Sixteen years ago patient had pain and swelling in ankles and fingers. Two years ago she had another similar attack. Both ankles and all fingers were painful to motion, red, and swollen. For past year and a half the knees have been stiff and painful.

Four years ago patient had severe infection of throat involving left tonsil, with brawny induration of left side of neck. Cultures taken were negative for diphtheria. Very painful and difficult deglutition at that time. Has frequent sore throat. For past four years has had shortness of breath and palpitation

of heart upon exertion. Has noticed that feet and legs were often "doughy," more marked when on her feet. Night-sweats two or three times a week for past ten months. Urination twice each night for eight months.

Appetite good; digestion not very good; takes special diet. Bowels constipated; always requires cathartic.

Habits good and regular. Patient is housekeeper, with great responsibility.

Menstruation began at sixteen and a half years. Regular until three years ago, when periods were very irregular. No period for one year.

In past two years has lost 26 pounds; usual weight 190 pounds.

Patient thinks present attack of arthritis followed "grip" ten weeks ago. The fourth finger of her right hand began to swell, hurt and burn, then second finger of left hand, followed by similar symptoms in all fingers and legs. Patient went to Hot Springs for treatment and remained there for five weeks without relief. For past two weeks knees have been severely swollen and painful, muscles of neck and back are sore, and there is tenderness in region of hips. Throat feels sore now. Grating sensation of toes present past year and a half, more marked now.

Physical Examination.—All lower teeth are replaced by plate except two crowned ones. The upper left lateral incisor and right bicuspid alone remain whole. The upper left lateral incisor and upper left bicuspid are crowned. Exudate from edges of gums shows amebæ.

The nose, pharynx, and tonsils are negative (Dr. Sluder).

Auscultation and percussion of lungs negative.

Cardiac dulness 14 cm. to left in the fourth intercostal space, extends to right 3 cm. in third intercostal space. At fourth left costal cartilage is a soft diastolic murmur, not definitely heard over aortic area, conducted toward axilla and audible as far as anterior axillary line. There is a systolic murmur in aortic area conducted upward.

Abdomen soft; liver and spleen not enlarged; kidneys not palpable.

Examination of pelvic organs negative.

Blood and urine negative.

Shoulders and elbows are painful. There is grating at base of skull. The left wrist is red and swollen; the ring and middle fingers show spindle-shaped swellings involving second phalangeal joints. Same condition in less degree in ring-finger of left hand. Distal phalangeal joint of left little finger is red, tender, and swollen. Left knee shows tense, fluctuating swelling below and to inner side of each patella.

Symptoms continued under treatment for eighteen days. Then the two lower teeth were extracted. Attempts to get material from roots of dead teeth through canals failed.

The swellings in the knee-joints continuing, the right knee was aspirated and about 8 c.c. of cloudy yellow fluid withdrawn. Culture made, but no growth. Smears show large numbers of polymorphonuclear cells. Patient says knee does not hurt as much since tapping; pain in left knee quite severe. Left knee-joint remained tense and painful. It was aspirated and about 10 c.c. of turbid fluid obtained. Since the aspiration swelling and pain in right knee-joint has been less severe. Now very little evidence of fluid, with more distinct outline of patella. Aspiration of left joint did not lessen either effusion or pain immediately; in fact, pain was more severe after aspiration, but in twenty-four hours pain and tension subsided, with improvement in patient's general condition for two or three weeks.

By five weeks after admission the arthritis was about as at first. After a slight remission of symptoms patient continued to have arthritis in many joints for four and a half months, notwithstanding constant efforts at local and general treatment, including care of the mouth by a dentist. The knees and fingers were almost always severely inflamed.

Tonsillectomy was then done at my suggestion, for although the tonsils showed no marked evidence of disease they were deformed, adherent, and always unhealthy looking. The tonsils were small. The left contained a small cavity. The wounds healed without complications. Two organisms grew from the tonsils: Staphylococcus albus and Streptococcus hemolyticus. Cultures were grown and an autogenous vaccine made, one con-

taining 250,000,000 staphylococci and the other 50,000,000 streptococci to the cubic centimeter. She was given cultures of both germs every fourth day for two weeks. There was soreness in knees after the injections, but no definite reaction. Then improvement began, and in a short time the patient was able to walk about the building in comfort.

She was discharged six months after admission. Following this the patient has continued her work for five years without loss of time. She has occasional arthritic symptoms, but nothing severe. She still has some defective teeth.

In this case some will look upon the vaccine as the curative agent. I would not deny this, but would again point out that the tonsils were of no known use to the patient and that it was only after they were removed, the most seriously diseased teeth having been extracted before, that definite improvement began and continued. More than the usual difficulty was encountered in getting the patient's consent to the tonsillectomy. In general, it seems that people are more willing to lose suspicious teeth than suspicious tonsils. In each case the relative severity of the disease should determine the order of attack, and on the ground of experience it is well to point out that we remove or treat only known local disease, and that even after radical treatment of all foci discovered there may be others that must be searched for and investigated—anything, one might say, between the sphenoid cells and the urethra or Bartholin's glands.

CLINIC OF DR. WILLIAM ENGELBACH

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ENDOCRINE AMENORRHEA

Comparison of Endocrine Types. Analysis of the "Hormonic Signs" Diagnostic of These Secretory Disorders. Report of Classical Cases of Amenorrhea Due to (*a*) Pituitary, (*b*) Thyroid, and (*c*) Ovarian Insufficiency. Treatment.

THE 4 cases for demonstration this afternoon have for their chief complaint *amenorrhea*, a cessation of the menses. The amenorrhea in the first two cases presented is due to pituitary, in the third, to ovarian, and in the fourth, to thyroid insufficiency. Only classical cases, in which there is a decrease in the secretion of these endocrine glands sufficient to produce a longer or shorter amenorrhea, have been selected. Three of these cases happen to be of the same age (eighteen), facilitating comparison. These frankly positive cases have been chosen in order to point out as forcibly as possible the gross diagnostic points denoting insufficiency of these three important endocrine organs and to emphasize the influence of the secretion of these ductless glands upon menstruation and genital function. While it is true that the strikingly complete insufficiencies herewith described are not common, yet minor degrees of deficiency of each of these glands producing less complete suppression of the menses, dysmenorrhea, and metrorrhagia, as well as loss of libido, frigidity, and sterility, are among the most frequent complaints of female patients. A careful study of the classical and extremely conspicuous "hormonic signs" present in these cases should be helpful in the diagnosis of milder forms, due to partial insufficiency of these three important internal secretions. Moreover, it should supply much information concerning the interrelationship of the

endocrine glands and the hormonic effects of their secretions upon other organs and metabolic processes.

Confidence in the diagnosis of these cases is based upon the fact that the pituitary cases (I and II) are counterparts of similar clinical cases reported by Lorain, Levi, Bell, Rennie, Kummell, and Falta. These cases have the very unusual combination of a markedly arrested osseous and genital development, associated with amenorrhea and absence of other genital functions *without the adiposity of a Froelich's disease*. This complex is explained only by one endocrine dystrophy, that of insufficiency of the anterior lobe of the pituitary gland, without additional involvement of the posterior lobe of the hypophysis. The thyroid case (IV) has a history and all the minute markings of a preadolescent insufficiency of the thyroid, associated with long periods of amenorrhea, reacting completely to a simple thyroid treatment. The ovarian insufficiency case (III) is a classical individual of extreme gonadism, having the most exquisite osseous development of this disorder, associated with a refractory amenorrhea of more than two years' duration. Various other symptoms, such as pernicious vomiting, emaciation, and angioneurotic edema, were present in this case, which reacted to treatment consisting of the substitution of ovarian substance. The three types are simultaneously described in order to accentuate, by contrast, the difference in the "hormonic signs" diagnostic of these disorders. All the local causes for amenorrhea have been excluded by repeated examinations, including in one case (III) exploratory operation.

CASE I

Miss M. L., eighteen, clerk. Gen. No. 727, August 20, 1919. Referred by Dr. E. A. Turek, Alexian Brothers' Hospital.

History.—Chief complaint is amenorrhea. No evidence of menstruation to the present age. Normal at birth and during childhood. The first tooth appeared at six months, and all the milk teeth were present at the end of second year. The patient walked not later than the thirteenth month; talked well at age of one and a half years. During childhood was unusually bright,

going through school with ease at the same rate as other children, graduating from high school at the age of sixteen. No adiposity or puffiness of the hands or feet was noted at any time during the course. No change in character or growth of the hair,

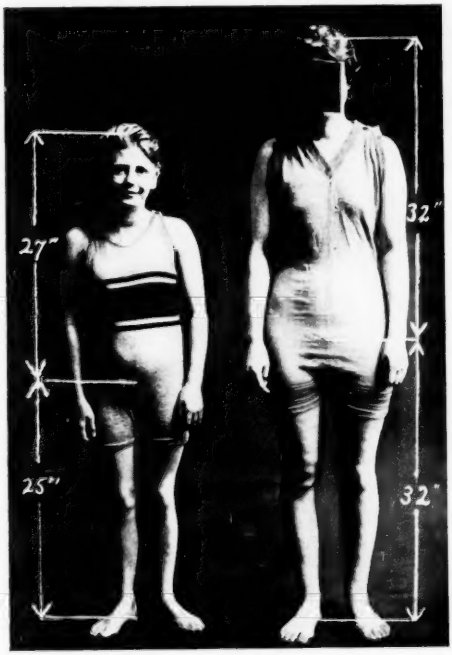

Fig. 60.—Case I, at the left, compared with the normal of same age on the right. Note the general retardation of osseous development and the increased upper 27 inches to lower 25 inches measurements in Case I as compared to the normal, upper and lower measurement being equal.

which is oily. Perspiration was normal, no gastro-intestinal or nervous disturbances. The patient has failed to mature or develop secondary sex characters at the age of eighteen. There has been no increase in growth since the age of thirteen or fourteen. *Past history:* Measles three times. Typhoid (possible

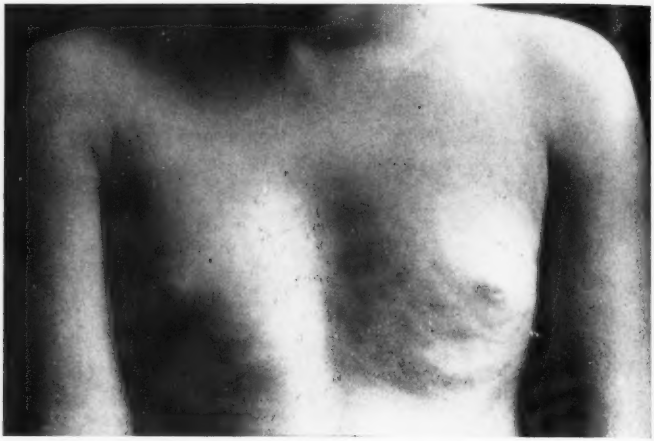

Fig. 61.—Case I. Note absence of secondary sex characters: virgin mammæ and absence of hair suit.

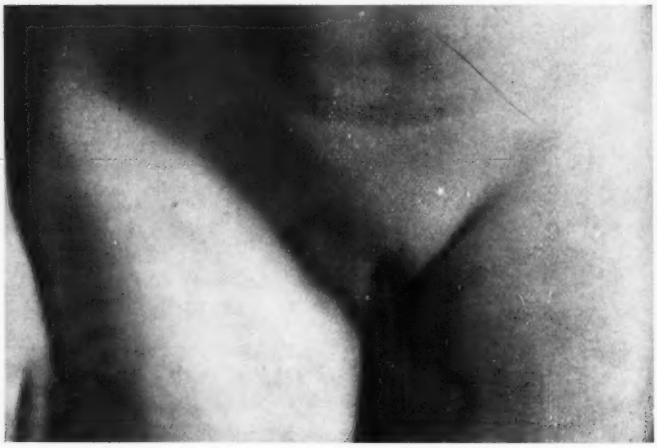

Fig. 62—Case I. Note the absense of hair on mons and virgin vagina.

etiology) at the age of fourteen. Frequent tonsillitis followed by otitis media. Personal and family histories negative.

Examination.[1]—Weight 78 pounds, height 4 feet, 9 inches. Measurements: *Vertex to symphysis, 27 inches* (69 cm.); *symphysis to soles of feet, 25 inches* (64 cm.); span, 56 inches (142½ cm.). Typical hypopituitary hand "en petite" (one-third smaller than normal), without clubbing or tapering of fingers. Head rather large for rest of body; circumference 20½ inches (51½ cm.); superior maxilla, 16¼ inches (41 cm.); inferior maxilla at tip of chin, 15¼ inches (39 cm.). Circumference at navel, 25 inches (63½ cm.); at hips midway between trochanters, 29¼ inches (72 cm.); middle of thigh, 13¾ inches (35 cm.); leg, 10

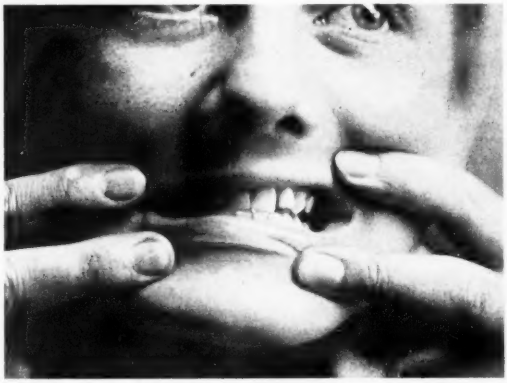

Fig. 63.—Case I. Note the long upper incisors with the small upper canines. Narrow tapering fingers.

inches (25½ cm.). Complete *absence of secondary sex characters*, very slight lanugo on mons, absolutely no hair in axillæ or on face, breasts not developed. Face has typical infantile characters. Hairline rather low, eyebrows very thin. Nose slightly retrousse. No adiposity. Pulse slow, but otherwise normal. Blood-pressure 124/90. Profile, slight recession of chin. Mouth showed recession of lower jaw, with poor occlusion of anterior teeth, *upper incisors very large, lateral canines very small*, all permanent teeth present except posterior molars. Thyroid, both

[1] Normal and negative signs omitted.

lobes and isthmus slightly full. Urine negative except for slight trace of albumin. Blood examination, including Wassermann, normal. Carbohydrate tolerance increased. Blood-sugar, first hour, 180; second hour, 120. Basal metabolism —.108 per cent. *x*-Ray of the skull showed a normal sella turcica. Skiagraph of the hand; epiphyseal lines clearly seen in head of radius and in all metacarpals and phalanges. Complete ossification had taken place in carpal bones. Phalanges free from tufting or mushrooming. Bones are slender.

CASE II[1]

(The patient first came under observation at the age of twenty-seven, in January, 1910, suffering from an acute tonsillitis. At that time her skeletal development induced the inquiry into her menstrual history, which revealed that no menses had occurred to date. The summary history is as follows.)

Mrs. E. W., aged thirty-seven, housewife; American. With the exception of the absence of menses and concomitant secondary sexual characteristics the age of adolescence was free from infections, climatic influence, shock, or other known conditions which might influence maturity. On account of her apparently normal conditions no attempt was made to induce menstruation until the age of fifteen. At that time she began to consult physicians, who during the succeeding four years gave her various ineffective treatments consisting of iron tonics, alteratives, sitz-baths, suprapubic cuppings, vaginal tampons, dilatations of the cervix, and numerous uterine curetments. No impairment of the general health, abnormal configuration of the body, localized deposition of fat, or vicarious menstruation occurred up to the time of her marriage at nineteen. Marital intercourse produced no change upon her amenorrhea. Since her marriage patient claims to have had definite sexual desires, and sexual intercourse has been carried out with some pleasure, but without orgasm. Patient continued in the same amenorrheic condition until about the age of thirty-three. At that time there was a very slight menstrual flow occurring every eight or nine months. This was

[1] Reported in Medicine and Surgery, No. 11, Feb., 1918, p. 193.

not sufficient to require the wearing of menstrual pads, and the duration was less than twenty-four hours. During this entire time there has been no marked change in the stature, height, posture, or deposition of fat. No other complaints and but few intercurrent diseases, such as tonsillitis and mild bronchitis, and

Fig. 64.—Case II. Note short stature, short long bones, virgin mammæ, absence of hair under arms and on chest, and absence of girdle obesity.

Fig. 65.—Case II. (Posterior view.) Small hands, short bones of the arms, absence of girdle obesity.

a few insignificant injuries were present during the twenty-four-year course since the age of maturity. Personal and family history negative with the exception that two sisters are both short and stocky individuals, but have no abnormal menses.

Examination.—Short, infantile type of woman, with girlish face; weight 127 pounds; head small, long bones not developed,

hands and feet very small, but in proportion to size and development of remainder of body. Measurements: height, 5 feet, 1 inch; circumference of head, 22 inches; chest expiration, 31½ inches, forced inspiration, 34½ inches; humerus 13 inches; forearm, 10 inches; head to navel, 25 inches; navel to soles of feet, 39 inches; circumference at navel, 27 inches; lower leg, 16½ inches; circumference of thigh, 18 inches; circumference of leg, 13 inches. No marked abnormal distribution of fat; absence of supraclavicular fat pads, mammæ small, plump, virgin type, no definite girdle obesity, no fat about lower portion of thorax posteriorly, or deposits in the abdominal wall, very slight fulness about the hips down to midline of femur, no deposition of fat above mons. Slight chloasmic pigmentation about the body, no skin lesions or scars. Abnormal distribution of hair absent; lips and temporal regions anterior to ears free from lanugo, eyebrows and eyelashes normal in amount and character of hair, slight amount of fine hair in the axillæ, upper pubic hairline very straight and clear cut, absence of hair on the chest, abdomen, and extremities. Pulse slow, no special type. Blood-pressure 126/108. Temperature 98.6° F., respiration 18. Temperament phlegmatic. Regional: No abnormal signs except those referable to diminutive osseous development. *Blood* and *urine* normal. *Roentgenogram of the head:* entire head small. Sella turcica very small, anterior and posterior clinoid processes approximated. *Roentgenogram of the hands:* bones fragile, decreased in density, terminal phalanges pointed, free from tufting. Eye examination: No changes in color field or perimeter markings, fundus normal. Carbohydrate tolerance increased. Blood-sugar .098 per cent. following 200 and 400 grams of glucose given throughout twenty-four hours, during which time 1 c.c. (1 : 1000) adrenalin was given intramuscularly. Blood-sugar decreased to .089. Twenty-four-hour urine free from glucose. *Injection of pilocarpin*, ⅙ gr., produced no salivation or sweating.

CASE III

Miss B. A., aged eighteen. Gen. No. 1358, 7/16/20. Duration previous to first observation one and a half years. Onset

sudden. Diffuse pain over entire abdomen with some tenderness localized at McBurney's point. The initial symptoms continued for four months, accompanied intermittently by a low temperature. At the end of this time a diagnosis of appendicitis was made and patient operated upon by Dr. Frank Lutz. A good recovery resulted from this operation and temporary relief with the exception of an occasional vomiting spell occurred for two months. After this time reappearance of all symptoms, consisting of pain, tenderness, distress in the right lower quadrant of the abdomen (over the crest of the ilium) and more or less constant vomiting following intake of food, occurred. Added to this syndrome was a typical migraine which was not present before operation. This consisted of headache associated with visual disturbance, scotomata, followed in a number of hours by nausea and vomiting. The attacks of abdominal pain, nausea, and vomiting were present, however, independent of the migraine. Dyspnea following exertion and acne of the face and chest were later complaints. *Past:* Measles, mumps, scarlet fever, diphtheria, pneumonia, acute articular rheumatism, whooping-cough, chicken-pox. Menses began at the age of thirteen, always regular until three months previous to admission, since which time none has occurred. Four days in duration, free from pain, constitutional cramps, or disturbances. *Family:* Negative.

Examination.—Height 5 feet, 9 inches, weight 140 pounds. Long slender girl showing considerable loss of nutrition, but fair color. Positive findings were cardiorespiratory murmur over the heart and pain in the inguinal region. Vaginal findings negative. There was some tenderness along the thighs and tibia. Urine and feces negative. Blood examination, Wassermann positive 2 plus. Spinal fluid Wassermann negative, cell count and globulin normal. Fluoroscopic examination of the chest and stomach normal, colon small and spastic. Skiagraphs of the chest, lungs, heart, and vessels normal. *Orthopedic examination* (Dr. A. E. Horwitz): "Periostitis of the right ilium, arthritis of right sacro-iliac joint, periostitis of the right femur, and beginning periostitis of both tibia, origin luetic." Nose

and throat examination (Dr. C. F. Pfingsten): "Sinuses normal, small but infected tonsils, vocal cords slightly thickened, and small degree of infiltration."

Fig. 66.—Case III. Anterior (right) *before treatment*, weight about 90 pounds. Note eunuchoid hands, and proportions and extreme emaciation.

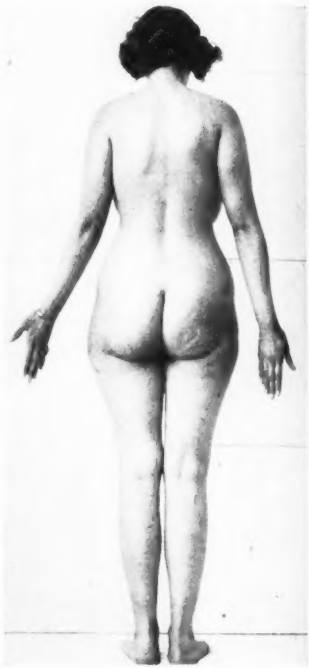

Fig. 67.—Case III. Posterior (left) *after treatment*, weight 156 pounds. Note return of classical gonad adiposity, particularly the trochanter adiposity. (Anterior view of this case after treatment center in Fig. 70.)

Treatment.—On the basis of signs of the periostitis and a 2 plus Wassermann, patient was placed upon a prolonged antiluetic treatment consisting of salvarsan intravenously, mixed treatment by mouth, and intramuscular injections of $HgCl_2$

During the following three months under this treatment the pernicious course was not interrupted. There was a continual loss of weight, increase in the amount of pain and discomfort in the lower right portion of the abdomen, persistent vomiting, etc. At this time, three months after entrance, patient was discharged from hospital, but continued to take antiluetic treatment by mouth.

Re-admittance February 2, 1917. Patient re-entered hospital for a very severe angina and diffuse stomatitis. This had been present for one week accompanied by severe dysphagia and low-grade fever. Old symptoms of vomiting, abdominal pain, and headaches had been present since previous observation. Examination of mouth revealed an aphthous stomatitis which cleared up under three weeks of local treatment. Two intravenous salvarsan treatments were given during this stay in the hospital, patient was discharged, relieved of mouth and throat infection, but unimproved as far as original gastro-intestinal symptomatology was concerned.

Re-admittance September 30, 1917. Chief complaints: (1) Cramping pains across the epigastrium and lower portion of the abdomen. (2) Marked tenderness over right ilium and sacro-iliac region. (3) *Amenorrhea for the past fourteen months.* (4) Headaches and vomiting fifteen minutes after eating associated with intensification of pain in the epigastrium and lower portion of the abdomen. (5) Attacks of sudden *edema of face, hands, and feet.* For the past few months the patient has been taking practically no solid food. Diet consisted almost entirely of orange juice and tea. Did not vomit blood or pass mucus or blood in the stools. Eight months previously for the first time the patient noticed marked *edema of the body*, involving the face, hands, legs, and feet, swelling very marked and pitting on pressure. No localized redness or itching. Onset of this swelling was very sudden and intermittent, and it would disappear within twelve to twenty-four hours in some attacks.

Re-examination: Emaciation more marked, weight less than 100 pounds, color more anemic, nails and lips slightly cyanosed. Pulse rapid, low volume and tension. Other general and re-

gional findings as on previous examination. Blood-pressure 115/80. Single and twenty-four-hour specimen of urine normal. Blood analysis, leukocytes 4820, erythrocytes 3,280,000, Wassermann negative. Stomach analysis, free HCl 15, total acidity 35. Lactic acid negative, microscopic negative. Basal metabolism plus .1 per cent. *x*-Ray examination, fluoroscopic of the chest and stomach normal, *x*-ray of the colon normal, free from spasticity.

Patient remained in hospital from August 30th to October 19th, during which time she was again placed on antiluetic treatment consisting of intravenous injections of salvarsan, intramuscular injections of Hg, mixed treatment of $HgCl_2$ and KI. by mouth, without change in the course of her condition, which grew progressively worse. During this stay in hospital her other symptoms were nausea, vomiting, and pain in the epigastrium. Her condition became so bad that an exploratory operation was advised. Patient's weight had decreased to below 90 pounds, weakness was extreme. While under observation numerous attacks of angioneurotic edema occurred, consisting of edema of the face, hands, and feet, the face swelling so much that the eyes were closed and lips were enormously enlarged. In order to prepare for operation transfusion with compatible blood was given, which was followed by a terrific reaction, consisting of marked cyanosis, collapse, vomiting for a number of days. After her condition improved sufficiently to make operation a safe procedure a laparotomy was performed by Dr. John Young Brown. At this operation the entire abdomen was found free from lesions and adhesions; cecum and pericecal periotneum were absolutely free from adhesions. The stomach, duodenum, gall-bladder, and entire gastro-intestinal tract were found absolutely normal. The uterus was well developed, ovaries slightly decreased in size, but not abnormally so. The operation consisted of a simple but thorough exploration.

On the basis of the negative findings at operation, the absence of reaction to luetic treatment, and the general eunuchoid build, associated with amenorrhea, the patient was placed upon

treatment for hypogonadism. The marvelous effects of this treatment is given in a summary of an observation made from notes June 6, 1920: "Following operation patient took corpora lutea injections once daily and corpus luteum, grain 10, after meals by mouth. Within two weeks she stopped vomiting entirely and began to retain liquids. Within a month she began to gain weight and has gained consistently (total of over 60 pounds), now weighing 156 pounds. Has had some complaints of soreness and pain in the abdomen, but no severe pains either in the gastric or right inguinal region. Has had an occasional headache which can be controlled by 10 grains of aspirin, feels perfectly well in every way, had had complete relief of all symptoms with the above exception of the slight soreness in the abdomen and occasional headache. The menstrual periods have not returned to date."

CASE IV

Miss M. I. Gen. No. 3437. Service of Drs. Engelbach and Tierney, St. John's Hospital. Age eighteen; school girl. Chief complaints: (1) Amenorrhea from six to eight months in succession. (2) Feeling of exhaustion. (3) Ocular weakness. (4) Pain in the region of the coccyx. Irregular attacks of amenorrhea have occurred for four years. Patient matured between the age of eleven and twelve, after which had regular copious menses of five or six days in duration, free from pain uninterruptedly until the age of fourteen. From the age of fourteen to eighteen menses were absent for intervals of six to eight months, after which she would menstruate for two or three months in succession. When present they were five to six days in duration, of normal amount, and free from pain. Last menses occurred two months previous to examination, lasted eight days, were copious in amount and painless. During these four years of transient amenorrhea patient has felt more or less weak and exhausted. Ocular weakness has been particularly marked, interfering with studies. Pain in the region of the coccyx has been present intermittently. Ecchymotic spots not due to trauma have occurred on various portions of the body at fre-

quent intervals. *Past:* Date of teeth eruption not known exactly, but mother thinks that this occurred late. *Had rickets when an infant,* being three years old before being able to walk. Chicken-pox without complications. Family and personal history negative.

Examination.—Stature short, measurements from symphysis to vertex, 29 inches (74 cm.); from symphysis to soles of feet,

Fig. 68.—Case IV. Note the deep-set squinting eyes and high saddle-nose

29½ inches (75 cm.); span, 62 inches (157 cm.); height, 4 feet, 10½ inches (149 cm.); circumference of head, frontal region, 22⅜ inches (57 cm.); at upper maxilla, 17½ inches (44 cm.); at lower maxilla, 16¼ inches (41 cm.); chest, 27¼ inches (69 cm.); abdomen, 23¾ inches (60 cm.); symphysis, 33 inches (84 cm.); length of humerus, 11 inches (29 cm.); forearm, 9½ inches (24

Fig. 69.—Case IV. Note the retrosseau nose, full, thick lips, the large upper incisors, and the small upper canines.

cm.); femur, 15½ inches (39 cm.); lower leg, 15 inches (38 cm.); hands long and slender, slightly clubbed, wrists narrow, no dorsal padding. Head wide with low forehead, anterior angle inclined forward, face round. *Deep saddle nose,* with *decided retrosseau* point. *Eyes deep set, lips thick, lower teeth* very *slightly overcrowded.* No supraclavicular or posterior cervical fat pad-

ding, no unusual obesity about breasts, abdomen, or mons. Hair distribution slightly thin on scalp, eyebrows slightly thinned at temporal sides, eyelashes normal, slight lanugo on upper lip, neck, and inferior maxilla. Absolutely no hair on abdomen or chest, very slight amount on extremities. Secondary sex characters present, breasts fairly well developed, virgin type. Axillary and mons hair present, skin slightly thick, not excessively so, not dry or scaly. Few ecchymotic spots over body, no abnormal pigmentation. Pulse slow, regular, equal, symmetric, slightly quick in rise and fall, not well sustained. Temperament phlegmatic. Blood-pressure 130/100. Regional: Thyroid not enlarged. Heart endocrinous: apex-beat, four and a half fingerbreadths to left of sternum, circumscribed, not forceful. No diastolic shock, thrill, or rub. Borders, apex-beat, left border sternum, fourth rib. Sounds, at the apex very slight presystolic murmur, disappearing with deep respiration. Systolic murmur over pulmonic area, "tit-tat" phenomenon over manubrium. Large vessels of chest and neck negative.

Urine analysis normal. Blood, including Wassermann, negative. *Carbohydrate tolerance increased:* blood-sugar (after 85 grams of dextrose), first hour, .087; second hour, .085. Feces negative. *Roentgenogram of the hand:* epiphyseal ends of radium and ulna not closed. Carpal bones all ossified, some lines along epiphyseal ends of both phalanges and metacarpal bones, no tufting at ends. *Roentgenogram of the head*, sella turcica large, anteroposterior diameter, $\frac{1}{2}$ inch (13 mm.); superior depth, $\frac{3}{8}$ inch (10 mm.). No other abnormal markings.

DISCUSSION

Diagnosis.—These three types of endocrinous amenorrhea will be contrasted diagnostically in order to accentuate the signs of glandular disorder producing much the same menstrual disturbance. In amenorrhea due to thyroid insufficiency the very *early personal history* is of the most significance, whereas this feature is of less prominence in the pituitary or eunuchoid menstrual disorders. In these latter two the *family history demonstrating type-signs* is much more important. The first

point of inquiry in the suspect thyroid individual should be the *size* and *weight at birth*. Every baby over 10 pounds in weight or of an unusual size at birth should be suspected of having been influenced by prenatal deficiency of the thyroid. Instead of a 14-pound baby being the pride of both obstetrician and father it should be one in which thyroid treatment should be given from the first few weeks of life. This treatment would probably help to prevent many of the early, so-called gastro-intestinal upsets and the peculiar nocturnal insomnia to which these infants are subject. Another suspicious abnormality which should attract the attention of the general practitioner and obstetrician is that of *late healing of the cord*, or so-called *infection of the navel*. For instance, the speaker has records of a cretin child fourteen years old in whom the navel had never healed. This patient had been subjected to many examinations and various treatments, from local applications to *x*-rays and Finsen light, without any effect upon the infected navel present since birth. The condition healed within two weeks after the institution of thyroid treatment. The next significant happening in the chronologic development of a hypothyroid infant is the *late* appearance or *eruption of the teeth*. Every baby whose first teeth do not appear at the end of the sixth month should be suspected as having a degree of insufficiency of the thyroid gland. The speaker has noted an opposite condition in the pituitary infants. A great many of these babies have teeth appear *before* the sixth month. The next event in the life of a baby indicating insufficiency of the thyroid gland is *late walking* and *talking*. If at the end of twelve or fourteen months a child is not able to stand alone and walk a few feet at a time or begin to say monosyllables, deficiency of the thyroid should be considered. It will be noted in the history of Case IV the statement that rickets was present in the first few years of life, delaying the active locomotion until the age of three. This history is a very common occurrence in these individuals. Many of them have been treated with braces and other mechanical treatment by competent orthopedists who have never suspected the underlying cause of the osseous lesion.

The next age during which thyroid cases should be apprehended is that of school inspection. These *defective children* are easily recognized by the unbiased instructors *in the kindergarten or primary grades* of school where an opportunity is presented for comparing the mentality and development of children of the same age. The retardation of progress during the first school year is frequently due to some blunting of sound or sight perception and not to lesions of the sense organs. The retardation in the special sense perceptions should at least suggest a possible hypothyroidism, and the previous history detailed is usually sufficient for a diagnosis.

The *early menstrual history* in these three different types of individuals certainly offers a decided contrast. The hypothyroid girl *menstruates at a much earlier age than the normal.* This is demonstrated by referring to the history of Case IV, whose first period occurred between the age of eleven and twelve. The speaker has noted that in a series of cretins in which there was a complete insufficiency of the thyroid gland, adolescence occurred from the age of *nine* to *eleven* years. In the hypothyroid individual besides the periods coming on before the age of thirteen there is always a tendency at least in the first few months or years of menstrual life to have an *increase in the duration* of the menstrual period and *absence of dysmenorrhea.* They require from three to six pads a day. There is rather consistent absence of local as well as general distress, such as cramps, headache, malaise, languor, etc. The opposite is true of the eunuchoid girl. In these individuals the periods usually appear *after the age of fourteen.* They have a tendency to be of shorter duration, two or three days, scanty in amount, and accompanied by more or less dysmenorrhea. This dysmenorrhea consists of a great deal of pelvic pain and distress, and is frequently located *over McBurney's* point, which often leads to a diagnosis of appendicitis. The *constant relation of this pain to the menstrual period,* however, *should help to prevent such a mistake.* Besides these local disturbances a great many general symptoms are present, among which are nausea, vomiting, backache, extreme malaise, and general distress. This characteristic menses with the same group

of dysmenorrheic symptoms is frequently present in a hyper or excessive secretion of the thyroid gland. The clinical fact of the early appearance of the menses, its profusion, prolonged duration, and freedom from dysmenorrheic symptoms in the hypothyroid individual and the opposite condition in the eunuchoid and hyperthyroid individual, lead the speaker to conclude that the *thyroid secretion is an inhibitory hormone to the gonads*. When this substance is withdrawn[1] more or less completely in the hypothyroid, menses occur as described above. Whereas, when an excessive thyroid secretion is present in the body the inhibition is so great as not only to delay the age of occurrence of the first period, but to suppress the normal menstrual act and produce the short, scanty, and irregular painful period present in hyperthyroidism. The delay of the menses until the fifteenth or sixteenth year by an excessive thyroid secretion also tends to produce the eunuchoid type of individual so frequently found associated with an early deficiency of the internal secretion of the gonads, the same as occurs in the early castrate. The pituitary type of individual as described in Cases I and II, typical of complete insufficiency of the anterior lobe of the hypophysis, never mature at all, or, if they do, late in adult life. In less complete insufficiencies of this lobe of the hypophysis the adolescence may take place at the normal age or be delayed for a number of years, depending upon the degree of inactivity of the lobe. During the first year or two of the menstrual life there is usually a history of *cessation of periods for a number of months in succession*. In the milder cases the menses may occur at normal intervals, but are imperfect in duration, amount, and are frequently associated with more or less dysmenorrhea and migraine. In contrast with this intermittent amenorrhea the eunuchoid individul has a *gradual decrease* in all elements of the menses. The history of ovarian insufficiency present in the eunuchoid individual as illustrated in the history of Case III is rather classical. This consists of menses that come on *after* the fourteenth year, and may be fairly normal for the first four or five years, gradually

[1] Additional evidence corroborative of this conclusion is the late age of the menopause in hypothyroidism.

decreasing in duration, amount, and regularity, accompanied by increasingly severe dysmenorrhea. The development of the genital organs in these three cases are also quite different. In the amenorrhea associated with preadolescent anterior lobe hypopituitarism there is an infantile genital tract with absence of secondary sex characteristics. This is not true in the partial insufficiency of ovaries or thyroid. In these eunuchoid girls the genital organs have already been developed and the secondary sex characters present before the onset of the ductless gland disorder. In the *hypothyroid* there is usually a very early *over-development* of both the *primary* and *secondary sex organs*. The mammæ are well developed at the age of ten to twelve, and this usually precedes the onset of the first menses. In eunuchoidism, while there is no marked retardation of the development of the internal genitalia, there usually is some tendency toward imperfect development of the secondary sex characteristics, the mammary glands are usually undeveloped, and the absence of hair-suit is quite constant.

The most important differential diagnostic signs indicative of a ductless gland disorder producing abnormal menses in these three types of endocrinous individuals are the gross and local changes in the body due to their secretory effects. These have been termed "hormonic signs," and can be defined as the general and local changes of development, growth, and metabolism produced by the presence or absence of the secretion of these endocrine glands. These hormonic signs divide themselves naturally into two groups—those referable to the body as a whole, "*the general hormonic signs*," and those affecting regional portions of the body, "*the local hormonic signs*." Among the general hormonic signs are such anatomic characters as the weight, stature, height, with the important analysis of proportions. A comparison of the upper measurements (from the symphysis to the vertex—short and flat bones) to the lower measurement (symphysis to the soles of the feet—long bones), as well as a comparison of the height to the span. Other general signs are the adiposity, hair-suit, pigmentation, pulse-rate, temperature, and blood-pressure. The *local hormonic signs* are regional changes produced by osseous,

adipose, and genital development. For instance, the shape and size of the head, hands, and the configuration of the face are classified as local hormonic signs indicating over- or inactivity of one of these important glands. The outline of the face, whether it is round, angular, hexagonal, the peculiarity of the setting of the eyes, shape of the nose, thickness of the lips, size and placement of the teeth, chin, neck, characters of the mammæ, hands, genitalia, etc., are the most important easily recognized *local* hormonic signs. The most contrasting differences of these types is due to the effect of these hormones upon the activation of the ossification centers of the bones during the preadolescent age. Withdrawal or reduction of the hormones of the internal secretion of the ovaries produces a marked overgrowth of the long bones by allowing the hormones of the pituitary and thyroid to overstimulate these osseous centers and permit them to continue in activity longer than in a normal individual. Consequently, when there is an insufficiency of this internal secretion from the ovaries there occurs an *unusually tall slender individual* having characteristic proportions and measurements, due to an overgrowth of the long bones, producing the eunuchoid type (Case III). Whereas in the other two types of individuals having an insufficiency of either the thyroid or the pituitary gland, the stimulating hormones of both long and short bones are absent. Consequently, there is produced a very *short stocky* (undergrown) *individual.* You will note from the illustration comparing these Cases I, III, and IV that the eunuchoid girl is almost twice the height of the hypothyroid and the hypopituitary individual. The characteristics of the phalangeal bones of the hands are also entirely different from those in Cases I, II, and IV. The unusual growth most frequently occurs during the age of adolescence, and the history of its presence just at that time is always significant of eunuchoidism, whereas the early history that the patient has not grown in height during or after adolescence should make one think of a possible hypothyroid or pituitary disorder. Besides this unusual height present in the eunuchoid (Case III) the disproportion in the measurements is quite indicative. It will be noted that the *lower measurement* is 3 inches *longer than the*

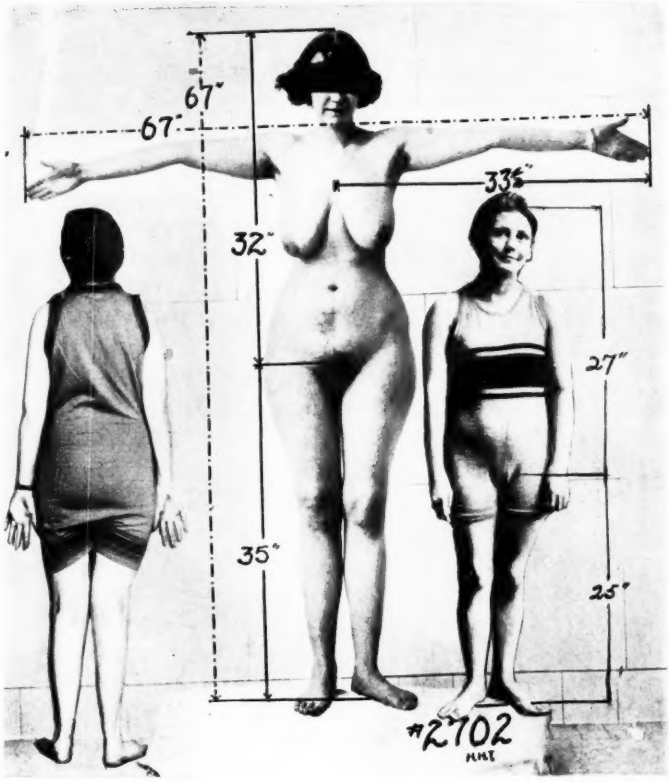

Fig. 70.—Comparison of Case I, pituitary (right), eunuchoid, Case III (after treatment—center), and thyroid, Case IV (left), insufficiency. All same age. Note retardation of growth of pituitary and thyroid (right and left) as compared to eunuchoid (center). Note the difference in upper and lower measurement of eunuchoid (center, 32 in.: 35 in.) as compared with pituitary (left, 27 in.: 25 in.). Note the return of the classical gonad obesity (after corpus luteum treatment) of Case III (center) consisting of mammary and trochanter adiposity. Compare with figure taken before treatment.

upper and the *span equals the height.* The upper and lower measurements merely offer a rapid estimation of the comparative development of the short and long bones; the upper of short and

flat bones and the lower of long bones. In the *pituitary individual the opposite effect on the osseous growth is produced*, and if disproportion occurs the short and *flat bones* are *overdeveloped as compared to the long bones*. For instance, in these cases the upper measurement is longer than the lower and the *span shorter or equal to the height*. With the exception of the general retardation of growth in the thyroid type the measurements may be either pituitary or eunuchoid in proportion. In the hypothyroid the development of the carpal bones is the most significant osseous sign. There should be one carpal bone fully developed to its periphery for each year of the individual's life. In some of the speaker's hypothyroid cases at the age of fifteen, for instance, all the carpal bones were yet not fully developed. Similar retardation in the growth of the flat and long bones occurs in these individuals in the preadolescent variety which is always undersized as to development of all their bones. They do not have the classical small head and feet that are present in the hypopituitary individual. It will be noted in Case IV that the hand bones are unusually long and slender. The *head* in the hypopituitary type is unusually small as compared to the rest of the body in the bilobar cases, but fairly well proportioned to the rest of the body in the anterior lobe insufficiencies on account of the lack of development of all the bones in this variety. This tendency to microcephalic head does not produce a marked change in the shape of this head or its facial features on account of the uniform retardation of development of all the bones making up the head and face. In comparison with this small well-formed pituitary head we have the unusually large head with round face in the hypothyroidism and a disproportionate elongated, sharp featured, hatchet face, and receding chin in the eunuchoid individual.

The *nose* in the hypothyroid girl is usually short and blunted with a high saddling and retrousse tip, whereas the nose in a hypopituitary girl, comparatively small throughout, is a well-shaped Grecian type with perfect nostrils. The nose of a eunuchoid individual is rather long, but of good shape, with sharply angled contour. The *lips* in the hypopituitary individual

are thick, full, and have a tendency to eversion, while the mouth and lips in the eunuchoid individual are small, with very thin and delicate lips, forming a mouth which has a tendency to be oval in shape. The lips in the pituitary girl are not particularly characteristic, although they do not have a tendency to be either over- or underdeveloped in thickness or size. The *teeth* in the hypothyroid individual are very poorly set, with a marked tendency to irregularity in outline and placement; this is particularly true of the upper canines, which frequently are misplaced very markedly either anteriorly or posteriorly to the normal tooth-line. The lower front teeth are always overcrowded and very irregular. In the eunuchoid individual there is a decided tendency to an enlargement of the upper incisors and a decrease in size or a congenital absence of the upper lateral incisors. The pituitary individuals usually have a well-developed and perfect occlusion, lateral and horizontal, of the teeth, although there may be a tendency to an enlargement of the upper incisors in those cases which have a secondary absence of the menses. The *chin* in the eunuchoid girl is usually receding in character and narrow. In the hypothyroid individual it is, on the contrary, more frequently wide and blunt, whereas in the pituitary type there may be some recession in those who have a marked secondary tendency to eunuchoidism, particularly in those having a complete absence of development and function of the genital system.

The *hands* and *feet* of the hypopituitary cases are unusually small, the hands, "type en petite," are one-third the size of the normal individual, with narrow wrist and short but fragile and tapering fingers. The feet in these individuals rarely develop beyond a third of the normal size for the age. Women of this type after reaching maturity frequently wear shoes Size 2 or 3. In decided contrast to this the hand of the eunuchoid girl is extremely long, slender, and artistic. The wrist is usually exceedingly narrow, the fingers disproportionately long, narrow, and pointed. There is no marking so characteristic of the hypothyroid hand except in some cases there is a tendency to dorsal and finger padding. This myxede-

matous swelling is usually transient and most frequently present during the time of the imperfect menstruation. At this time the fingers feel very much enlarged, stiff, and the rings worn ordinarily with comfort can barely be removed. In some of the speaker's cases this false edema has been so transient as to be present for only an hour or two, recurring at long intervals. It has been found to be much more inconstant than the typical dorsal padding found in the adult myxedema; in fact, many outspoken cases of the early deficiency of the thyroid with very marked menstrual disturbances do not present this sign. The feet in the eunuchoid individuals are usually long and shapely with no other special characteristics. In the thyroid individuals there is a tendency to flat-feet or lowering of the arch which might be responsible for their late locomotion.

In the laboratory observations made upon these cases the *roentgenograms* of the *head*, *face*, and *hands* confirm the physical signs which have been described above. The small short tapering fingers, as compared with the long phalanges with tapering ends, correspond to the descriptions of the pituitary and eunuchoid hands as given above. The absence of development of the carpal bones to their periphery corresponding, one to each year, is present in the hypothyroid individual. The very short nasal bone in the pituitary case as compared to the unusually developed one in the eunuchoid is easily demonstrated in the radiograph. The *basal metabolism* is important in confirming the hypothyroidism, as in these cases the rate is usually much below normal. This decided decrease in rate is not present in the eunuchoid or pituitary individual; comparatively few of the very marked hypo-activities of these glands have a rate which is 10 per cent. below the normal. The majority of the cases will fall within the normal basal metabolism and some few even have a slight increase in metabolic rate. Practically the same thing occurs in the changes of *carbohydrate tolerance*, another gross measurement of metabolism. The hypothyroid cases have a very decided increase in this tolerance, and the pituitary and eunuchoid cases have practically a normal blood-sugar following the intake of the standard amounts of glucose.

The *symptoms referable to other organs* and *systems* in the early cases of these dyscrasias are extremely valuable. In the *thyroid* individual the systems which are most markedly and frequently affected are the *dermal*, the *nervous*, and the *circulatory* system. It has been the experience of the speaker that the gastro-intestinal and renal systems are not so frequently involved in the early ages. The changes in hair growth, such as partial alopecia, the subdermal infiltration, the skin impregnation producing a lardaceous or alabaster color, are among the common signs in the early cases associated with genital abnormalities. Among the common nervous symptoms is the general depression producing a deficiency of all mental action with a decrease in special sense perception. A tendency to stupor or somnolence with loss of memory, mental confusion and consequent disorientation, is present in various combinations and degrees of intensity. Marked sensory disturbances producing peculiar hyperesthesias, pruritis, tingling, etc., are among the common peripheral nerve disturbances. The circulatory signs are those referable to the rate and rhythm of the heart. Many of these cases have an unusually slow, irregular pulse, associated with subnormal temperature, which is relieved entirely by thyroid medication. The common complaint of all three types of these individuals is the unusual muscle and mental fatigue. This is probably most frequently found in the thyroid and eunuchoid individual, but also present in less degree and evidence in the pituitary case.

The *eunuchoid individual* presents symptoms referable to other systems which are very misleading, having a tendency to direct the diagnostician toward those systems instead of to their source—the ovaries. The system which is most decidedly and frequently affected is the gastro-intestinal tract, as was demonstrated in the classical case of eunuchoidism herewith described (Case III). Pain in the left lower quadrant of the abdomen associated with spasticity of the colon not relieved by the ordinary treatment for colonic spasticity is also frequently an accompaniment. An intermittent ptyalism has been the chief complaint of a few of these cases. A *rapid and persistent decrease in weight and tendency to anemia* sometimes overshadows the

whole clinical picture. In contrast are the thyroid cases which, if anything, have a tendency to increased weight because of their very marked decreased metabolism.

Symptoms referable to other systems in the pituitary individuals most frequently affect the head, eyes, and gastro-intestinal tract. In these cases there are recurring and persistent attacks of migraine usually affecting the eyes, probably among the most disturbing chief complaints. A small percentage of them have peculiar attacks of nausea and vomiting related to the menstrual week. The gastro-intestinal symptoms are more frequently a part of the migraine attacks, but sometimes are absolutely independent of headaches or ocular signs. These gastro-intestinal symptoms are more frequently relieved by the pituitary treatment than are the headaches and ocular disturbances. The nervous make-up and mentality of the pituitary individuals are quite decidedly different from either the eunuchoid or thyroid individuals. The pituitary child is precocious in its progress through school and is ambitious and energetic in the undertakings and activities outside of school. They are frequently oversensitive, critical in their estimations, and flighty and changeable in the projection of their own work. They lack the susceptibility to infection so frequently present in both the thyroid and eunuchoid individuals, very rarely having nose and throat or pulmonary infections common to these types.

Treatment.—The treatment of these menstrual disorders consists of a simple substitution of the deficient hormone in sufficient dosage. Enough is already known about the *treatment of an incomplete hypothyroidism* at any age to make it unnecessary to go into much detail regarding therapy. In the majority of these adolescent hypothyroid girls increasing doses of thyroid substance are given by mouth until the tolerant dose is reached or until the symptoms are relieved. For example, in a girl of fourteen to twenty years of age with a basal metabolism which is not less than 30 per cent. below the normal an initial dose of thyroid gland, grain $\frac{1}{4}$ (.015), is prescribed three times a day after meals. This is increased grain $\frac{1}{4}$ each week until the first signs of thyroid intoxication appear. The earliest sign of a thyroid

intoxication is taken to be a tachycardia above 100, providing the pulse-rate was below 80 before the institution of treatment. This tachycardia is considered the best physical measure of the tolerant or physiologic dose. This tolerant dose is usually decreased by $\frac{1}{8}$ (.007) or $\frac{1}{4}$ grain (.015), and then continued for a few weeks to obtain further information about its effects upon the symptomatology. At this time, if the general symptomatology has not been improved, a basal metabolism reading is taken in order to determine whether the rate has been restored to normal. If this has occurred, the dosage thus measured is thought to be correct and this treatment continued for a number of months. At the end of two or three months if there has not been a material improvement a re-examination is indicated to determine the correctness of the diagnosis. If the symptoms are relieved by a smaller dose than a tolerant one, it is not necessary to continue to increase the dosage, but more advisable to use the smallest dose possible that will produce relief. After the symptomatology has been completely removed, such as restoration of the periods to normal and relief of any other system symptoms, it is a question in the mind of the speaker whether it is advisable to increase the dosage to that point necessary to restore the basal metabolic rate.

In the *treatment of the eunuchoid* female a different rule applies as to measuring the dose of the ovarian substances indicated in the individual patient. In these cases the basal metabolism does not serve as an index to the dosage, and the only dependable guide is the reaction to this therapy in the form of relief of the clinical syndrome.

Various preparations by a number of pharmaceutical manufacturers are on the market under different names. *"Ovarian substance,"* made from the corpus luteum and stroma of the ovary, is supposed to contain the internal and external secretions of the ovary. This preparation is administered by mouth (gr. v to xx—.3–1.3) and hypodermically (♏xv to xxx—1.–2.). *"Corpus luteum"* (Parke, Davis & Co.) and *"Lutein"* (Hynson, Westcott & Dunning) are preparations of the corpus luteum for oral use. *"Corpora lutea"* (Parke, Davis & Co.) and *"lutein ampules"* (Hynson, Westcott & Dunning) are *extracts* from the *corpus*

luteum for hypodermic medication. *"Ovarian residue"* (Parke, Davis & Co. and Hynson, Westcott & Dunning) is an *extract* from the *stroma of the ovary* for hypodermic usage. The dosage of these substances per oram is gr. v to xxx (.3–2.) and hypodermically ♏xv to xlv (1.–3.). These hypodermic preparations given subcutaneously rarely produce reactions, although occasionally a severe local reaction occurs. Corpora lutea has been given intravenously in 2 and 3 c.c. doses without producing severe local or general reaction. Absent or secondary sex characteristics indicate the use of the substance and extract from the stroma of the ovary (ovarian residue). Amenorrhea and loss of ovarian function due to the external secretion from the corpus lutea is supposed to demand corpus luteum preparation for its correction. The speaker has two cases, however, in which this apparently produced a complete amenorrhea for a number of consecutive months. Personally, no very decided difference in the effect produced in corpora luteum to that of extract from the stroma has been demonstrated. In nearly all of those cases where decided effect has resulted from the use of one of these ovarian substances the result was obtainable from the other. On the contrary, in those cases in which no effect was obtained from one, very little, if any, was observed from the use of the other extract. In order to obtain definite results it is necessary to give these ovarian substances hypodermically. Full and complete relief of symptoms by the oral administration of large doses of any combination of these preparations has not been accomplished. Besides, the individual patient's dose must vary considerably, depending upon the amount of insufficiency present. In the above case of eunuchoidism it will be noted that the menstrual periods have not returned, while the symptomatology referable to her other systems, such as the nausea and vomiting, neurotic edema, loss of weight, etc., were relieved entirely following the use of corpus luteum alone. It will be interesting in this case to note the effect of substance from the stroma (ovarian residue).

The *treatment of the pituitary* amenorrhea likewise consists of simple substitution of the substance from the anterior lobe of the

hypophysis. The guide to dosage is the reaction of the clinical symptoms. In these cases basal metabolism does not serve as an aid to measuring the dose. The anterior lobe of the pituitary gland is now being marketed by both Parke, Davis & Co. and Armour's. This can be given in doses from gr. 2½ to 15 (.15–1. mg.). Antuitrin (Parke, Davis & Co.), an extract of the anterior lobe of the hypophysis, is given in ♏xv to lxv (1.–5. c.c.) subcutaneously, intramuscularly, or intravenously, without any decided reaction. Cushing reported a "thermic reaction" resulting from giving this substance to those individuals who had deficiency of the anterior lobe of the pituitary gland. This thermic reaction, consisting of a temperature as high as 101° F. following injection of antuitrin, has not been observed except in the speaker's cases of either anterior lobe or bilobar varieties. As high as 5 c.c. of this substance have been given intravenously to the pure anterior lobe cases without observing a change of temperature for one hour after its introduction. Smaller doses given subcutaneously and intramuscularly have always been unproductive of thermic changes. These results led to the conclusions that the thermic test is of little value in diagnosis, or as a measure of size of the dosage necessary in these disorders. If at any time the pituitary symptoms are increased, the treatment should be stopped. For example, a production of typical pituitary headache or an exaggeration of the ocular, gastric, or uterine signs following the injection of this extract would indicate that a mistake in the activity of the secretions of this lobe has been made, and there was probably a hypersecretion instead of a hyposecretion, as originally diagnosed. On the other hand, if the relief of symptoms was quite marked, such as freedom for long intervals from the attacks of cranial, ocular, and gastric symptoms, marked relief of muscle fatigue regularity and increase in the amount and duration of the menses, or improvement in libido and improvement or relief of sterility, it would be proof of the beneficial effect of this medication.

BIBLIOGRAPHY

1. Lorain: Preface de la These de Foneau de la Cour, Paris, 1871. Ref. Apert in Traite, des mal de l'enf (Granther), 1904, I, 993.
2. Levi: Nouv. Icon. de la Salpetriere, 1908, xxi, 297 and 421. Contribution a l'etude de l'infantilisme du type Lorain.
3. Bell: The Pituitary, 1919, Part I, p. 79. Incidence, The Physiology of the Pituitary, Ibid., p. 237. Incidence, Hypopituitarism Occurring Before Puberty, Ibid., pp. 158–177. Incidence, Effect of Posterior Lobe Secretion Upon the Gonads.
4. Rennie: Endothelioma of the Pituitary Gland with Infantilism, Brit. Med. Jour., June, 1912, p. 150.
5. Kummell: Growths of the Pituitary Gland, Muenchen. med. Wochenschr., 1911, p. 1293.
6. Falta: The Ductless Glandular Diseases, Falta and Meyers, pp. 229–328.
7. Cushing: The Pituitary Body and Its Disorders, 1912.

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THE PHYSICAL EXAMINATION OF THE NERVOUS SYSTEM OR SOME OF THE ESSENTIALS IN NEUROLOGIC DIAGNOSIS

IN this course I shall endeavor to bring certain *facts* and *methods* to your attention. We shall not deal with theory. There is much in neurology we do not know, but there is a bit we do know that is eminently practical. Moreover, we may use this bit, if we will, in our study of each case that presents itself to us. There is already ample knowledge which justifies the phrase *physical examination of the nervous system*, and it has the same application as *physical examination* of the heart, lungs, or abdominal viscera. An adequate physical examination of the nervous system is the foundation of all accurate neurologic diagnoses. In this course we shall not study disease as such, but rather we shall study the methods which should be employed in *data-getting;* in other words, we shall study *some of the essentials in neurologic diagnosis.*

If we think of the several *physiologic activities* of the nervous system, we have at once a line of inquiry which must engage our attention in the study of the individual. These activities are manifested in four chief directions: (1) *the mental state;* (2) *the state of sensation and the special senses;* (3) *the state of motility;* (4) *the state of reflexes.* We cannot determine whether the individual has a normal nervous system unless we investigate him from each of these points of view. If we will do this, we can determine, almost beyond a doubt, whether the individual has organic or *functional* disease. We should, however, be able to go a step further in the majority of cases, and say

what part or parts of the nervous system are affected. We should always try to answer in each case these questions:

First, Has the individual organic or functional, or a combination of organic and functional disease?

Second, If organic, what is the location of the disease process?

Third, What is the nature of the disease process?

If we are careful in *data-getting* and in *data-interpretation*, the first and second questions can be answered in most cases, but we are not always able to find the nature of the disease process. This question, however, may often be answered through the *proper use* of our *senses and reason*, through the *proper use* of instruments of precision, and through the *proper use* of those methods that have come to us in recent years from the laboratory; in other words, through a study of the *whole individual from every possible point of view*.

We shall not here dwell upon *psychiatric methods;* these will be given to you by another. In this course we shall confine our study chiefly to the methods of data-getting in connection with *motility, reflexes, sensation*, and the *special senses*. Today we shall begin the study of a man whose physiologic activities in these directions are supposed to be normal. He is forty-five years old and came to the hospital a few days ago, giving the history of a recent attempt *to take a long rest*, and he still bears a large scar on the front of his neck. He is now glad that he is alive, and desires to aid us in our work.

SOME OF THE PERVERSIONS IN MOTOR FUNCTIONS

Individuals who have advanced organic disease of the nervous system usually disclose, almost at a glance, some abnormalities, and these are often more striking in motor activities than in any other. Consider, for instance, an individual with *spastic paraplegia*, another with Bell's palsy, another with *Parkinson's disease*, another with hemiplegia, and still another with advanced *locomotor ataxia*. As you know, locomotor ataxia is not an affection of the motor apparatus, but of the sensory system leading to a motor manifestation, which we call *ataxia*. Whether the location of the disease process be in the motor or

sensory neurons, organic disease usually manifests itself in some perversions in the state of motility, and I may also add in the state of the reflexes. Perversions in motor function usually manifest themselves:

First, In *change of attitude* of a part or of the whole; the only exception to this rule is found in the slightest degree of weakness.

Second, In the *manner* in which and *the force* with which movements are made.

Third, In the *wasting of muscles*, which may be general or limited to particular groups.

Fourth, In the *diminution* or *absence* of visible and palpable muscle contractions when given movements are resisted.

Fifth, In the degree of strength which under normal circumstances is proportionate to the degree of muscle development.

Sixth, In the condition of *muscle tonus*, which may be increased, diminished, or absent.

Seventh, In the presence of tremors, tonic or clonic spasm of muscles.

Eighth, In *inco-ordination* (ataxia), which may be due to cerebral, cerebellar, spinal, or peripheral disease.

Ninth, In *plus*, *minus*, or *absent mechanical irritability* of muscles and of superficial nerve trunks, and in *altered* electric reactions of nerves and muscles.

Tenth, In *station*, in *gait*, in *speech*, in *swallowing*, and in *sphincter* control.

These several points must be kept in mind when one would determine the *state of motility*. You have noted how quickly this man removed his clothing: no hesitation, tremor, or inco-ordination became manifest. We have seen nothing abnormal about his attitudes nor his manner of making movements which is even suggestive of motor disturbance. As he walks to and fro before us each step is taken with relative precision. As he stands still his feet are not widely separated and he stands firmly upon them without swaying. We have found thus far no evidence of *perverted* motility.

After this general survey of motor function, let us begin with the head region, as there are certain points which have to do

with *motor cranial nerve function* that we should always investigate. We should note the state of the innervation of his *facial* muscles. Are the palpebral fissures of the usual dimensions and equal? Do his *globes* occupy a normal relation with the orbits? Is he *cross-eyed?* If so, has he been so from birth? Is his *squint* due to recent or remote ocular muscle palsy, and if so, what muscles are involved? Are his pupils as they should be—round and equal—and in size proportionate to age and illumination? Is there *nystagmus* while globes are at rest or only in end positions? In either case is this sign equal right and left or more marked on one side or the other? Is it fine or coarse, rapid or slow? Are his oral fissures symmetric at rest, in movement, and in emotional states? Are his *tongue* movements equal and do they work in unison? Is his *soft palate* equally innervated? Is there difficulty in *swallowing?* Do the *shoulders* occupy the same plane at rest and in active movements? Are there any *abnormal attitudes* about his head, upper and lower extremities, and trunk? Are there abnormalities either about the *skull* or *spine?* Is there *wasting* or weakness of any muscle group? Is there alteration in muscle tonus? Are there mechanical hindrances to free joint excursions? Is there *any change* noted about the tendons, muscles, or joints? Is there *inco-ordination*, *tremor*, or muscle *spasm?* Is there *clonus* of any muscle groups, particularly of forearm, pronator, wrist, finger, ankle, or patellar groups?

SOMETHING ABOUT REFLEXES AND SPECIAL SENSES

After we have thus investigated motility, we next turn our attention to superficial (skin) and deep (periosteal and tendon) reflexes. There are many reflexes, but only those that are relatively constant are of definite value in neurologic diagnosis. The tendon and periosteal reflexes which are relatively constant and which may be mentioned are the *jaw jerk*, the *orbital*, the *radial*, the *biceps*, the *triceps*, the *knee* and *Achilles'* reflexes. Among the relatively constant superficial reflexes are the *corneal*, the *palatal*, the *abdominal*, the *cremasteric*, and the *sole* reflexes. The reflexes thus far mentioned must be considered *physiologic* reflexes, and any one, or some, or all of them may be unduly active,

diminished, or absent. The character of reflexes aids us greatly in differentiating between organic and functional disease. In addition to these reflexes there are certain reflexes called *pathologic* because they are not present in health, and occur only in the presence of disease. Among these are Chaddock's wrist sign and the so-called pathologic toe reflexes, the most dependable of which are Babinski, Oppenheim, Gordon, and Chaddock. I shall have more to say about the significance of physiologic and pathologic reflexes when I shall later on attempt to demonstrate the methods employed in eliciting them.

After investigating motility and reflexes, we should next turn our attention to sensation and the special senses. In our conversation with our patient we have noted nothing wrong with his hearing. We should always inspect the external ear (meatus, canal, and drum) and test *auditory* acuity. Visual acuity should also be tested, likewise the limitations of visual fields for form and colors. Please remember that no physical examination can be considered complete without the knowledge that can come to us only through the *ophthalmoscope*.

We next turn our attention to the senses of smell and *taste*. To test the sense of smell, asafedita, cologne, etc., may be used, and for the sense of taste substances without odor, weak acid, salty, sweet, and sour solutions should be brought in turn to the anterior two-thirds and posterior one-third of the tongue.

SOME PRACTICAL POINTS IN TESTING SENSATION

Skin sensation and sensation of the bones and joints should next be investigated, and to this end no elaborate armamentarium is required. An ordinary pin, some cotton-wool rolled to a fine, flexible point, hot and cold test-tubes, and a coarsely vibrating tuning-fork represent the required instruments. Before the sensory examination is begun we should explain to the patient just what we expect of him. We should never say to him, just at the moment we apply the stimulus, do you feel the head? do you feel the point of the pin? do you feel this or do you feel that? The patient should be taught to answer, without any prompting from the examiner, just what he feels. In test-

ing sensation certain other precautions always must be kept in mind: (1) the patient must be in a comfortable position in a warm, quiet room free from noise and other distractions; (2) his eyes should be blindfolded so that no dispersion of sensation may occur from effort to keep his lids closed; (3) one must have co-operation of the patient, and to this end his mentality must not be blunted; (4) each sensory root distribution should be stimulated in an orderly manner, and the degree of stimulus (right and left) must, as nearly as possible, be equal at all times; (5) we should avoid *summation of irritation*, as, for instance, in testing light touch with cotton-wool or pain sense with a pin, the touch should be the slightest discernible. The surface of the skin should always be touched at one spot with the cotton-wool or other instruments, and they should not be dragged over it, thus making summation. The examination should not be unduly prolonged, because the moment the patient gets tired his attention is dispersed and his answers become unreliable. A symptom of perverted sensation which is wholly subjective is called paresthesia, and described by patients as "dead," "numb," "crawling," or "tingling" feelings in a part. *Paresthesia* is a frequent complaint, and it may be present without any objective evidence of perverted sensation, but, because it frequently accompanies organic disease of the sensory apparatus and particularly of the cord and peripheral nerve, it is a symptom of great value. The chief physical signs of perverted sensation are alterations to (1) *light touch*, (2) *pain*, (3) *temperature*, (4) *deep sensibility*. Sensibility to *light touch*, pain, and temperature may be increased, diminished, or abolished. If these qualities of sensation are increased, we designate them respectively *hyperesthesia*, hyperalgesia, and hyperthermesthesia. If we find them diminished we designate them respectively hypo- or hypesthesia, hypalgesia, and thermohypesthesia. If all of these qualities are abolished, we then say there is *total* anesthesia, but if the sensation to light touch *alone* is abolished, we also *say anesthesia*, but without qualification. If we find total loss of pain sense, we say there is *analgesia*. If there is total loss of temperature sense, we say there is *thermesthesia*. In deep sensibility there are at

least two qualities involved: (1) the sensation experienced when deep pressure is made over muscles, tendon, nerves, bones, and joints; (2) one's awareness of the slightest passive movements of a joint when muscles are completely relaxed and when eyes are blindfolded. This quality of deep sensibility formerly was called *muscle sense*, but is now usually designated by modern neurologists as the *posture sense*. A coarsely vibrating tuning-fork is of value in testing deep sensibility. Such vibrations are diminished or absent in most *tabetics*, but sensation to vibration may also be altered in peripheral and cerebral disease. When completely lost it is called pallesthesia. We may also speak of *dissociation* of sensation, usually meaning by this term *retention* of sensation to light touch, with *diminution* or *abolition* of sensation to pain or temperature, or both. Accumulated neurologic observations have shown quite clearly that sensory loss in *other qualities* seldom occurs without alterations in *pain sense*. The *practical* application of this fact is that in the sensory examination *pain sense* should first be tested. If we find no disturbance to *pain*, stimulation and the *reflexes* are in no way abnormal, then we may be reasonably sure that sensation in all other qualities is normal.

Let me here suggest the necessity of keeping a record of the several points entering into the physical examination of the nervous system. The *graphic method* of recording physical findings is especially valuable in recording sensory changes, and such outlines of the entire body representing sensory root distribution are purchasable.

A CLASSICAL SENSORY SIGN

Romberg's sign is a classical sign of organic disease of the sensory apparatus. It has application, of course, only when the patient is able to stand alone. We speak of the position of the individual when standing as *station*. Rombergism is present when the patient is unable to stand without unduly swaying, when his feet are approximated and his eyes are closed. It must be remembered, however, that equilibrium in none is so perfect that he does not sway slightly in this position. I said *unduly*

swaying advisedly. In the adolescent and active periods of life when one is free from disease, swaying, with feet approximated and eyes closed, is very slight indeed. It is greater under normal circumstances in the very young and in the very old. Therefore, age alone may be responsible for considerable swaying when the individual is meeting the requisite conditions for this test. Moreover, individuals who are what might be called nervous, anxious, or who are apprehensive about the test or otherwise sway unduly, and this fact must also be considered in testing station—in looking for Romberg's sign. One who has Romberg's sign already manifests it in the manner in which he rises from a sitting to a standing position; in this, that his eyes are kept directed toward the floor, and he separates his feet widely before attempting to rise; he stands with broadened base. Taking this as a clue, we should first ask the patient while standing to approximate the sides of his heels and toes. If there is Rombergism, his present position will demonstrate it, but if it does not, we next ask him to look straight ahead, and then at the ceiling, and finally to close his eyes; in other words, we should proceed from the *easy* to the *difficult*. Individuals with marked ataxia cannot stand even with a narrowed base without swaying, pitching and tottering, and to stand with eyes closed is impossible, but Romberg's sign, like any other sign of organic disease, rarely exists alone. Associated with it are almost invariably some disturbances in sensation and alterations in tendon reflexes, and if there be no motor weakness and no wasting of muscles it is usually associated with pupillary anomalies as well. It is most often found with a syndrome, which we call *locomotor ataxia*, but it may be exquisitely present in *cerebral disease*, *ataxic paraplegia*, and in neuritis involving the lower extremities.

GAITS: NORMAL AND ABNORMAL

Just a word about abnormal gaits, and here again we should remember the so-called "normal" man. An analysis of gait shows that it is primarily a *trunk* movement and not a lower extremity movement. Until one shifts his weight, it is practically impossible to take a step, at least in a normal manner, so that

we may say we walk primarily with our trunk. Under normal circumstances it is the weight shifting to the opposite extremity which precedes each successive step. The hemiplegic patient must shift his weight markedly to the unaffected extremity in order to keep his *straightened* and *stiffened* extremity from dragging the floor. In the paraplegic state, if the weakness be not profound, trunk shifting is accentuated now with one side, now with the other, but if weakness be profound, trunk movement is *reduced*—the trunk is shifted forward and the feet drag along. In locomotor ataxia it is also reduced, but in cerebellar ataxia trunk swaying is so much accentuated that the gait becomes tumbling and gyrative like that of a drunken man. There are many gaits described in text-books, but all of them may be grouped under five headings:

First, The gait of stiffness, which may be one-sided (hemiplegic) or two-sided (paraplegic).

Second, The *gait of weakness*, as seen in the aged, in paralysis agitans, in beginning convalescence from a tedious illness, or in convalescence from toxic neuritis, etc.

Third, The *ataxic gait*, characterized by rapidity, overaction, and uncertainty, and by inco-ordination of trunk and extremities.

Fourth, The steppage gait, characterized by hyperflexion of knee and dangling and drooping toes.

Fifth, The *cerebellar ataxic* gait, characterized by marked overaction of trunk movements—gyrating and tumbling like a drunken man.

Sixth, the *hysteric* gait, characterized by the absence of all *voluntary* effort with the affected part or parts; if *hemiplegic*, the affected extremity is dragged along; if *paraplegic*, both extremities are dragged with the aid of some kind of support.

SOME PRACTICAL POINTS ABOUT PUPILS

Let me now try to demonstrate and comment upon some of the points to be covered in an orderly physical examination of the nervous system. To examine any part of the body the patient must be postured so that the two sides are in equal illumination and occupy the same relative positions. We have our

patient now sit before the window, and we are in front of him so that the parts to be examined are in equal illumination. Whether we would examine motility, sensation, or reflexes this is a rule never to be forgotten. To have equal illumination is the first requisite in the examination of pupils and their reflexes. As a part of the examination of the cranial nerve function no one thing is more important than an orderly examination of the pupils. In so-called normal man the pupils are symmetrically round and in equal illumination they are in approximately 85 per cent. of humans equal in size. In approximately 10 per cent. of so-called "normals" the inequality is due to an anomaly in development. Therefore, inequality in pupils in 90 per cent. of individuals is a sign of some abnormal condition formerly present or existing at the time. Unequal pupils are a departure from the rule, and are suggestive of something pathologic. Even though inequality may be congenital—normal to the individual—nevertheless it is a departure from the rule. We, therefore, have in simple inequality of pupils a *mandate*, to say the least, to make *further inquiry* and to determine by every possible means whether the condition be normal to the individual or a sign of previous or present disease. While pupils are, as a rule, equal in size in equal illumination in the healthy, yet they *vary* in size from moment to moment. Moreover, they are relatively large or small, depending upon the age of the individual. In the newborn and in the aged the pupil is smaller than in any other period of life, and it is largest during childhood and early adolescence. If this statement be true, we are justified in drawing the conclusion that it is normal for the relatively young to have large pupils and normal for the old to have small pupils. But a very small pupil, the size of a pinhead, or a very large pupil, with a width of more than 5 mm., is a *sign of something abnormal in any period of life;* hence a very small pupil in the relatively young and a very large pupil in the relatively old is contrary to the rule. If we look closely in good illumination at "normal" pupils we will note that the pupil is never quite at rest. It is in a state of what might be called *unstable equilibrium*—it *varies in size from moment to moment.* If it does not so vary, we have one of the signs of fixed

pupils or one of the signs associated with the Argyll-Robertson pupil. There are three reflexes of pupils which should always be tested, and these are the *consensual light reflex*, the *direct light reflex*, and the so-called *convergence* or *accommodation reflex*. You will note that I stand to the side and slightly behind so that my head is not in patient's direct line of vision. I then ask him to look at the ceiling. I next place my right hand over his right pupil, and, looking at his left, I note that his left pupil immediately widens, yet varies slightly in size. I remove the hand from the right eye and the left pupil contracts. Thus I have tested the consensual light reflex of his left pupil. I then reverse the procedure, and note similar responses in the right pupil. We are now prepared to make the notation—*consensual light reflex prompt right and left*. With the patient's eyes still fixed on the ceiling, I shade both pupils with my hands, and if we will look at the pupils thus shaded, we will see that they have both *dilated*. I now remove both hands at the same time, looking at the right and then at the left pupil, and I note that the *pupils contract*, and we now say direct *light reaction prompt right and left*. The so-called convergence or accommodation reflex is tested with the gaze still fixed on the ceiling. With the fingers of my left hand resting on the forehead I place my thumb from 2 to 5 inches above the bridge of the patient's nose, and ask him to look at my thumb; as he does so two movements are noted: *globes converge* and the *pupils contract*. The convergence reaction of the pupils is really an *associated* movement with that of the internal recti. If these are paralyzed or greatly weakened there can be no convergence reflex in pupils. Evidence that the convergence reflex is an associated movement is found in incomplete paralysis of the third cranial nerve. In such a condition the pupil remains immobile to this test. Moreover, it usually reacts neither to *consensual* nor direct light stimulation. In such a condition we make the notation—rigid or immobile pupils. When the Argyll-Robertson pupil is present the pupil is *immobile* to any method of light stimulation, but it *reacts promptly* in convergence. Here again let me emphasize the importance of noting the *oscillation* of the pupil and its *unstable* equilibrium in

health. When it does not oscillate, or when its movements are very slow, we have an early sign of something abnormal. Pupils react promptly to light stimulation in health, that is, there is an immediate, definite, and moderately rapid response, and when a pupil in good illumination does not react *promptly*, we say that it is *sluggish*. *Sluggish* pupillary reactions and *stabilized* pupils are among the first signs of the Argyll-Robertson pupil, third nerve palsy, and optic atrophy. If we would be helpful to our patients we must learn to recognize the beginnings of disease. It is in such phases that we may best serve.

I have thus far referred to inequality in size, the size of the pupil in the newborn child, in the adolescent and in the aged, and I have mentioned something about the behavior of the pupils in the several ways of stimulating their activity, but I should neglect a most important part of pupillary examination if I failed to mention the *contour* of pupils in health and sometimes in disease. In health in so-called "normal" man the pupil is symmetrically round or nearly so, and there are, indeed, but few exceptions to this rule. When the pupil is not round it must be interpreted as something either normal to the individual—a congenital malformation—or as a sign of former injury or disease, or disease present. The pupil which is irregular in contour—*jagged*, *lop-sided*, *uneven* or *oval*—means in the vast majority of cases *a sign* of present or former disease or injury. That I may demonstrate classical Argyll-Robertson pupils, which seems to illustrate many points, I will ask the class in groups of 4 to stand by the other patient before you, that each of you may see, at least, some of the phenomena to which we have just referred. Adopting the same procedure as with the first patient we note:

First, That both pupils are very small; this, too, in a man forty years of age.

Second, That the pupils are irregular in contour, the right transversely oval and irregular and the left diagonally oval with jagged margin.

Third, That both pupils remain motionless, that is, they are *stabilized—immobile.*

Fourth, That the consensual light reaction, right and left, is wholly abolished.

Fifth, That the direct light reaction, right and left, is wholly abolished.

Sixth, That notwithstanding the smallness of the pupils, they still react promptly when he looks at my thumb above the bridge of his nose.

Let me here say that it is not thinkable that the profound pupillary pathology in this case developed overnight; on the contrary, that which we have just witnessed has doubtless developed during the lapse of many years. Its genesis was probably something like this: a syphilitic infection twenty years ago; and had we examined this man six years after the infection, we should have found that one pupil was larger than the other, and still a few years later that one or both had become slightly irregular—the pupils had lost their symmetric roundness. Then the pupils in sequence, as time went on, became *less* mobile, and finally became immobile and *stabilized to light.* Had we examined his light reflexes before the pupils became stabilized we should probably have found them *sluggish.* Only a few years ago they probably became wholly *reactionless* to light, yet retaining, as they do today, *promptness* in convergence. The moral of this case is: *Search for beginnings of disease.*

FURTHER POINTS ABOUT CRANIAL NERVE FUNCTION

Just a few more practical points about cranial nerve function. If there be neither *seventh* nor *third* nerve paralysis, sympathetic irritation nor paralysis, and if there be no deformity about the orbits or lids, we expect the palpebral fissures to be equal. All the signs of normality just mentioned are present in both of the cases before you. There is neither ptosis nor undue widening of the fissures, nor any alteration in the position of the globes, nor any sign of facial weakness. A *widened* palpebral fissure may be due either to *sympathetic irritation* or to *facial palsy.* The *narrowing* of the palpebral fissure may be due to lid or *orbit deformities, third nerve palsy,* or *sympathetic*

paralysis. In some active manifestations of *hyperthyroidism*, exophthalmos, widened palpebral fissure, and widened pupil are signs of that condition, but in sympathetic paralysis we usually find the sunken globes, the narrowed fissures, and the small pupils. To those of you who may come in contact with injury of the neck or cord, knowledge of sympathetic behavior may have a definite localizing value. Let us assume an irritative lesion about the eighth cervical and first dorsal segment affecting only the right side, and we would then probably have on that side widened fissure, widened pupil, and exophthalmos. But if the lesion be *destructive*, one would probably find *narrowed* right fissure, smaller right pupil, and sunken right globe. In right-sided facial palsy we would have widened fissure, drooping eyebrow, and other signs of facial palsy so familiar to you that I shall not mention them. In complete third nerve palsy the lids droop. There is undue wrinkling of the forehead due to overcompensation of the occipitofrontalis muscle. In such a case, on separating the lids, the globes will be found turned outward and downward due to the action of the intact sixth and fourth nerves, and the pupils will be *widely* dilated, and, as I have previously stated, fixed and immobile to any form of stimulation.

If we find the soft palate equally innervated, neither difficulty in speech nor in swallowing, tongue movements equal in various directions, tongue occupying level position in relation to the floor of the mouth and showing neither fibrillation nor wasting, we may be sure that the nerves having to do with these motor activities are intact. There is another cranial nerve whose function we should not neglect, and that is *the motor fifth*. If the musculature supplied by this nerve is paralyzed, the mouth, when open, deviates toward the side of the lesion, and the voluntary movements of the jaw are limited to that direction. Moreover, we may test the *force of contraction* of the masseter and temporal muscles by palpating them during the patient's effort to firmly close his jaw.

A coarse test of *visual fields* may be made by seating oneself directly in front of patient with the eyes of the examiner and

patient occupying approximately the same horizontal plane and with about 30 inches intervening. I now have the patient close his right eye and keep the left open and look directly at my right eye with his left. I then bring a pencil within our fields of vision, midway between his eye and mine, and ask him to tell me when he no longer sees the pencil as I move it upward, downward, outward, and inward. Reverse procedure with the right, or opposite eye, and thus the visual fields may be tested. Controlling his visual fields with my own, I am able to demonstrate that the patient's visual fields for form are equal to mine. For charting fields, which includes not only form but color, a perimeter is employed. For quick orientation, however, the method I have just demonstrated may serve this purpose in many instances.

REFLEX ACTIVITIES: PHYSIOLOGIC AND PATHOLOGIC

Physiologic experiment and clinical observation have shown that the reflex activities of the organism are increased and diminished by whatever increases and diminishes the activities of the nervous system. Any condition or disease which affects the organism as a whole, or the nervous system in particular, is usually manifested by alteration in reflex activities. We possess no better means whereby we may definitely discern general perturbation of the whole organism and at the same time differentiate between health and disease than that afforded by investigating the more constant physiologic and pathologic reflexes. We must remember, however, that the activities of the physiologic reflexes *fluctuate within wide limits* even in healthy individuals—fluctuation being dependent upon age, occupation, habits, exercise, rest, etc.—so that in considering reflex alterations as a sign of disease this and similar facts must be kept in mind. Pathologic alterations in these physiologic reflexes may consist in so-called *exaggeration*, in *inequality*, in *diminution*, in *abolition*, in *disproportion*, and in *dissociation*. Dissociation of reflex activities exists when, for example, tendon reflexes are present and skin reflexes are absent, or the reverse. Example: It is the rule to find in ordinary hemiplegia the tendon reflexes about the affected side unduly active, with abdominals and cremasteric reflexes on the affected

side diminished or absent. The reverse of such findings is found in *abolished* tendon reflexes in advanced locomotor ataxia with retention of abdominal and cremasteric reflexes. *Disproportion* in reflex activities exists when either superficial or deep reflexes are relatively more active in one part of the body than in another. Example: Diminished knee-jerks and Achilles' jerks in beginning locomotor ataxia or in neuritis of the lower extremities and with "normal" activity of the upper extremity tendon reflexes. *Diminution* in tendon reflex activities is seen when a reflex is not readily obtained or is still weak when *maximum* stimulation controlled by all known methods of reinforcement produces *minimum* reaction. Example: Preataxic tabes, neuritis, spinal cord compression, milder forms of poliomyelitis, etc. *Abolition* in reflex activities exists when maximum stimulation controlled by all known methods of reinforcement fails to elicit the reflexes. Abolition in some of the reflexes is the usual condition found in severe neuritis, advanced locomotor ataxia, peripheral nerve lesions, and is usually present in complete transverse lesion (severance) of the cord. *Inequality* in reflex activities exists when a given reflex is unequal right and left. Example: Hemiplegic states, one-sided palsies, such as musculospiral palsies. *So-called exaggeration* in reflex activities exists when minimum stimulation produces maximum reaction, when the reflexogenous zone of a given reflex is broadened, and when associated response occurs in muscles not ordinarily affected by the stimulus. Example: Tendon reflexes in irritative and moderate lesions involving the pyramidal tracts, in some cases of lues cerebrospinalis, and in the milder hemiplegic states. In such conditions it may be frequently found in testing the radial reflex there is not only response in the supinator longus and biceps muscles, but also in the triceps, finger flexors, and even the forearm extensors and deltoid may respond to a single stimulus. Let me add that so-called *exaggeration* in reflex activities is the least trustworthy single sign of organic disease, because in *functional* disorders the picture just drawn may be approached. Our safety in interpretation lies in remembering *that a sign of organic disease rarely, if ever, exists alone.* Where we find what might be interpreted as *pathologic exaggeration* of reflex activities,

if it really exists, we are almost certain to find other signs, such as inequality or dissociation of reflexes, pathologic toe reflexes, rigidities, and clonus. In order that our findings in reference to physiologic and pathologic reflexes may be dependable we must have fixed rules in examining them, and among these are:

First, That the parts must be *free from all clothing*, in equal illumination, and occupy the same relative position right and left.

Second, That there must be *complete relaxation* of the parts or members, and securing of easy attitudes is helpful to this end.

Third, That one hand of the examiner, if possible, should be placed upon the part or member in order that he may *feel*, as well as *see*, the possible alteration.

Fourth, That the stimulus must be made with *gentleness*, because undue violence defeats the relaxation of muscles through exciting alarm and apprehension in the patient.

Fifth, That the activity of *paired* reflexes be *compared* one with the other, and the *degree of stimulus must be at all times equal right and left.*

Let us now examine some of the physiologic reflex activities and make the tests for pathologic toe reflexes on the two patients before you. One whom we suppose to be normal we will call A, and the other who presents a picture of advanced *tabes* we will call B. During the examination of A and B I shall have occasion to indicate the methods to be employed in testing for pathologic toe reflexes. Let us test first the reflexes of A, beginning with his *radials*. His upper extremities are in easy attitudes, and they occupy the same relative position with forearms flexed and with hands resting on thighs. Seating myself in front of him, I grasp his left wrist, bringing his forearm in position midway between supination and pronation, and place my thumb over the lower end of the radius. My thumb is placed in this position to avoid the *pain* that would certainly ensue from striking the bone, which is covered only by skin and a little subcutaneous tissue. With moderate force we now see and feel prompt response in the biceps and supinator longus muscle. I then grasp his right wrist in a similar manner, and see and feel a similar response. As far as we are able to determine the response is equal right and

left and otherwise normal. We now supinate the forearm; locate with the thumb the biceps tendon at bend of elbow; strike the thumb a rather sharp blow, and immediately a response occurs in the biceps muscle. The same procedure on the right elicits a similar response. Testing one and then the other, we find the *biceps reflex* right and left to be moderately active and equal. The triceps reflex is obtained by grasping the patient's wrist and by bringing the elbow almost to right-angle flexion and by tapping the short *triceps tendon* just above the tip of the olecranon. This technic yields a prompt response in the *triceps* muscle—right and left. We pass next to the lower extremity reflexes. The knee-jerk may be tested when the patient is sitting with the soles of the feet resting firmly on the floor and with thighs somewhat separated. When patient is in this position we place the left hand above the knee to feel if the thigh and hip muscles are relaxed and also to feel the force of contraction if the reflex is present. We next locate with our finger-tips the left quadriceps tendon between the lower margin of the patella and the tuberosity of the tibia, and we bring the blow of our reflex hammer to bear on the tendon midway between these points. We immediately see and feel the force of the contraction in the quadriceps group. A similar technic reveals a moderately active knee-jerk like that on the left. Another position for the patient, often effective in getting knee-jerks, is that one in which the patient sits on a table with his legs hanging over its edge. Still another position, the one preferred by me, effective in getting knee-jerks is to have the patient lying upon his back with knees flexed at about an angle of 45 degrees and thighs somewhat separated. Standing at the foot of the table I grasp the foot and strike the tendon; here again we may see, as well as feel, the force of the reflex contraction in the quadriceps muscles. In this position we note another phenomenon in getting knee-jerks, namely, that the *contralateral* adductor group contracts simultaneously with the quadriceps group. This is known as the *crossed adductor reflex*, which may constantly be elicited in the healthy in whatever position we posture the patient suitable for getting knee-jerks. While the patient is still lying on his back

and in the same position employed in testing knee-jerks, we test the *Achilles reflexes* in the following manner: Grasp the foot with the left hand, and bring it to position of almost right-angle flexion with the leg, thus placing the Achilles tendon somewhat under tension, and strike it just above its insertion into the os calcis. We both see and feel the force of the contraction in the calf muscle group which is the response in this reflex. If we sum up the reflex findings in this case thus far noted, we may say *radial*, *biceps*, *triceps*, *knee*, and *Achilles'* jerks are moderately active, equal, and proportionate.

In patient B, using the same technic, our findings are as follows: *Radial* and *biceps* reflexes are absent right and left; *right triceps absent; left triceps present only with reinforcement;* knee and Achilles' jerks, despite all methods of reinforcement, *absent*.

The pathologic toe reflexes which should be constantly tested are *Babinski*, *Oppenheim*, *Gordon*, and *Chaddock*, so called in honor of those men who first described them. Each of these reflexes has the same significance—each points to a lesion somewhere in the *pyramidal tracts*. The method of stimulation necessary to elicit the Babinski reflex is as follows: The patient should, if possible, be lying in bed with slightly flexed knees. With the point of a pin or nail-file the sole of foot, preferably near its outer margin, is briskly stroked from the heel region forward. In health such irritation causes either no movement or plantar flexion of ankle and toes. The *Babinski* reflex is present when there is hyperextension of the great toe irrespective of the behavior of other toes or ankle. *Oppenheim reflex* is elicited when knee is slightly flexed by running tips of fingers or a blunt instrument firmly and rapidly along inner margin of tibia, all the while pressing deeply into the calf muscles. In the *healthy* this method of stimulation produces plantar flexion of the toes and ankle, or no response in these parts. When the *sign is present* there is hyperextension of the great toe. The *Gordon reflex* is elicited when knee is in position of moderate flexion by boring tips of fingers quickly and firmly into the midportion of the calf muscles. In the *healthy*, plantar flexion of toes and ankle ensues, or these parts remain motionless. When the *sign* is present hyperexten-

sion of the great toe ensues. The *Chaddock* reflex is elicited by stimulating skin beneath and adjacent to the external malleolus. In the healthy no response occurs, or at least only slight flexion of the toes. When this sign is present the identical toe phenomena are elicited as in Babinski, Oppenheim, and Gordon reflexes. On patients A and B all of these reflexes are absent, but we shall have ample opportunity to demonstrate each of these important reflexes during subsequent periods. In each of these reflexes hyperextension *of the great toe* is the *essential* response, and this is true when any one of these reflexes is *typically* present, but any one of them may be *modified* in this, that the great toe remains stationary; whereas there may be hyperextension of two or more of the outer toes. Long experience has caused me to regard this *modified pathologic toe reflex* of equal importance with the *typical*, and in many instances of *greater* importance, because this *modified reflex* may precede the development of *typical* toe reflexes; in other words, the *modified* toe reflex is often the *earliest* manifestation of pyramidal tract involvement.

The *superficial* or skin reflexes which should be tested in every case are *sole*, *cremasteric*, and *abdominal*. The sole reflex is obtained by stimulating the skin of the sole with a nail-file; response *nil* or plantar flexion of ankle and toes. The *cremasteric reflex* is elicited either by stroking inner and upper surface of thigh or by quickly boring finger-tips into Scarpa's triangle. The response in the female is momentary furrowing of the skin paralleling Poupart's ligament, and in the male the same phenomenon, with rising of the testicle on the same side. The *abdominal reflex*, conveniently divided into *middle*, *upper*, and *lower*, is obtained by stimulating the skin with pin or nail-file along the outer margin of the rectus abdominis muscle; the lower below, the middle opposite, and the upper above navel. In the male subject, if the abdomen is not pendulous from fat accumulation or relaxation of muscle walls, this reflex is relatively constant, and, like other physiologic reflex activities, *equal* right and left in the healthy. In women who have borne many children, with consequent relaxation of abdominal walls or with pendulous abdomen, it is often absent.

In conclusion, let me add some statistical data relating to the constancy of the physiologic reflexes. The abdominal, cremasteric, sole, and radial reflexes are absent in approximately 20 per cent. of individuals free from organic disease of the nervous system, and whose joints and muscles are free from mechanical hindrances; whereas under similar conditions the *biceps*, *triceps*, *knee*, and *Achilles'* jerks seldom, if ever, fail.

It has not been possible in the time allotted to us to indicate all the methods which should be employed in making a physical examination of the nervous system. Today I have merely given an introduction to subsequent demonstrations. If I have succeeded in convincing you that an adequate physical examination of the nervous system is the foundation of all accurate neurologic diagnoses, our time has been well spent.

CLINIC OF DR. W. McKIM MARRIOTT

ST. LOUIS CHILDREN'S HOSPITAL

SEVERE DIARRHEA IN INFANCY

THE patient presented today is an excellent example of the end-results of severe diarrhea in a young infant. The patient is three months of age, and has been artificially fed on a variety of foods ever since birth. We do not know the details of the feeding, as the parents are Turkish and speak very little English. The family lives in very unhygienic surroundings. For at least a month the infant's stools have been frequent, usually green, and often containing mucus and a few soft curds. The infant has been under observation at a milk station for a week. During the past three days the diarrhea has been more severe than previously. From ten to twelve stools a day have been passed, which consisted largely of greenish-brown fluid with very little solid material. During the past week the child has lost 1 pound in weight. The mother says there has been high fever. A large part of the food given has been vomited.

On admission to the hospital the infant presented the picture of extreme malnutrition. The weight was 2650 grams (5 pounds, 12 ounces). There was no subcutaneous fat and the bones appeared very prominently through the extremely thin skin. The eyes were sunken far back in the sockets, the fontanel depressed. The skin was of an ashy gray color over the face and extremities, pallid elsewhere. It was quite inelastic and dry, and when picked up between the fingers a ridge was formed which remained for some time before flattening out. The respirations were deep and pauseless. The respiratory rate moderately increased. The rectal temperature taken shortly after admission was 40° C. (104° F.), although the hands and feet were cold.

The mental condition was one of apathy, the infant arousing for a few moments at a time and then lapsing into a semicomatose condition. The leukocyte count on the blood was 12,400. The heart-rate was rapid, but there were no adventitious sounds. There were no signs of any process in the lungs. The abdomen was sunken. Liver and spleen not felt. The ears, nose, and throat were negative to physical examination. Very little urine was passed; it contained neither blood nor pus. There was a trace of albumin. No casts. Acetone, a trace.

This particular infant is obviously in a critical condition, and we know from past experience that unless very vigorous treatment is instituted she is almost certain to die within a few hours' time.

Unless we have some insight into the actual processes taking place in this infant's body rational therapy is impossible. Let us, therefore, consider what changes have been brought about in the physiology of the body as a result of the severe diarrhea from which the infant has suffered.

During the period of prolonged diarrhea of the past month the absorption of food from the gastro-intestinal tract has undoubtedly been less than under normal conditions. Furthermore, the amount of food taken in has not been as much as usually taken by an infant of this age. This is because of the infant's lack of appetite and the fact that vomiting has occurred when very much food was given. Although the amount of food actually available for the body has been small in amount, the infant's need for food has been little if any less than that of a normal infant. Body heat has had to be maintained, the activity of the heart and lungs has been quite as great as in any infant of this age on account of the continual irritability and fretfulness characteristic of the infant with a chronic gastro-intestinal disturbance. There has been a very considerable amount of energy used up in the form of muscular movement. If the amount of food material brought by the circulation is insufficient to supply the necessary fuel for the purposes named, that supply of fuel must come from some other source. The body normally possesses a reserve source of food-supply in its stored glycogen and

fat. The glycogen is quickly utilized. The fat is drawn upon and ultimately may be almost completely consumed for fuel. When this source of supply is exhausted, either the life processes must stop or else protein, the essential vital framework of the body cells, must be used. This does take place in infants of this type, as has been shown by the fact that more nitrogen is excreted from the body than is taken in by mouth. This cannot keep up for any length of time without such serious injury to the body that recovery is impossible, no matter what treatment is subsequently instituted. This particular infant had apparently exhausted most of her fat supply. We do not know to what extent body protein had been broken down, but from the extremely emaciated condition of the infant it is probable that some destruction of protein has occurred in this instance.

This condition of extreme malnutrition from which this infant is suffering is in itself a serious enough one, but it has been complicated by even a more serious condition brought about as the result of the especially severe diarrhea of the few days immediately preceding admission to the hospital. It was mentioned that the stools were watery. A large amount of fluid was necessarily lost in this way. The child vomited considerably and, therefore, took in very little fluid. The high body temperature and the increased respirations were conditions favorable for an excessive loss of water from the skin and lungs. The net result has been that the infant's body has become desiccated. Desiccation of the body is serious, no matter whether it is brought about (as in this case) by an excessive loss of water, or by any other means, such as a diminished fluid intake or exposure to high temperatures. Practically all of the extreme toxic symptoms which this child has shown may be explained as the result of the desiccation of the body.

One of the simplest ways to determine the degree of desiccation of the body is to examine the blood-serum for protein content. When the blood is concentrated by water loss the serum proteins necessarily make up a larger, and water a smaller, portion. The determination of blood protein may be made either by the micro-Kjeldahl method or by the use of the re-

fractometer. By the latter method we found the blood protein of this infant to be 8.60 per cent. The normal protein at this age is 6 per cent. This finding was indicative of a very considerable drying out of the blood. Such a drying out of the blood would necessarily result in the diminution in its volume, and this was the case in this infant. The blood volume measured by the vital red method was found to be 6.1 per cent. of the body weight (normal 9 to 10 per cent.). Diminished blood volume, no matter how brought about, leads to a decrease in the rate of circulation, that is to say, when the blood volume is diminished the amount of blood passing through a given portion of the body in a unit of time is greatly lessened. To determine whether or not this had occurred in this infant the flow of the blood in the arms was determined by the Stewart method, and was found to be 3.4 c.c. per 100 c.c. of arm per minute (normal flow 17 to 20 c.c. per minute).

In any condition in which the volume of the blood is diminished there is usually a compensatory constriction of the arterioles, particularly those in the peripheral areas. In this way the blood-pressure is maintained and the circulation to the organs essential to life suffers less than it would otherwise. A simple method of determining whether or not arteriolar constriction has occurred is to compare the blood counts of capillary and venous blood. When arteriolar constriction occurs there is a damming back of the cells in the capillaries. In this infant the red blood-cell count on the blood obtained from the capillaries by puncture of the heel was 5,392,000; hemoglobin, 95 per cent. In blood obtained from the vein at the same time the red cell count was 4,100,000; hemoglobin, 80 per cent. There was evidently considerable constriction of the peripheral arterioles. This explains the peculiar gray pallor of the skin noted on physical examination. The constriction of the arterioles in this case was not sufficient to compensate for the greatly diminished volume of the blood sufficient to maintain a normal blood-pressure. The blood-pressure taken on the thigh by the auscultory method was: systolic 64 m.m., diastolic 35 m.m.

The very greatly diminished flow of the blood through por-

tions of the body results in a condition essentially the same as that occurring when the vessels to a limb are occluded. That is, there is an accumulation of acid products, chiefly lactic acid. This may be sufficient to lead to a severe acidosis. It was mentioned that this child's respirations were deep and pauseless. The breathing was exactly the type observed in diabetic coma. It was the characteristic breathing of acidosis. To determine the degree of the acidosis the carbon dioxid combining power of the blood plasma was determined by the Van Slyke method. This was found to be 17.4 volumes per cent. corresponding to the alveolar carbon dioxid tension of 12 m.m. These findings are indicative of a most extreme degree of acidosis. The acidosis in this case was probably not entirely due to lactic acid accumulation, but was in part due to a failure of the kidneys to excrete acid with a resultant accumulation of acid in the blood and tissues. The failure of the kidney function in this type of case is not due to a nephritis, but is the result of inability to separate fluid from the highly concentrated blood. The acidosis of this patient was not due to the acetone bodies, as there was only a very slight excess of acetone in the blood and a small amount in the urine.

With a diminished flow of the blood through the various organs of the body one would expect a very poor functional capacity of these organs. It is probably true that the flow through those organs most essential for maintaining life is less diminished than elsewhere, yet in such a severe case as this there is evidence of diminished circulation even to these organs, for example, to the heart muscle. An electrocardiogram made shortly after admission showed a distinctly abnormal tracing. The particular abnormalities were low QRS complexes, a very long P-R interval (0.160 second), and an iso-electric T wave in leads I and II. Such changes in the electrocardiographic tracing indicate that the heart muscle is performing in an abnormal manner. This might be due to a myocarditis, but inasmuch as in this case the abnormality disappeared following the establishment of a better circulation, it is probable that the changes were the result of a poor circulation in the heart muscle.

The high temperature of this child may have been due to infection or to the absorption of protein split products from the intestinal tract; or it may have been the result of a drying out of the body. Temperatures at least this high have been repeatedly observed following desiccation of the body, and such temperatures usually fall after a sufficient supply of fluid has been given. In this child no focus of infection could be discovered. The temperature did fall after the administration of a sufficient amount of fluid, although nothing was done that would have prevented the continued absorption of toxic products from the intestinal tract. It seems most reasonable to suppose that the fever was due to lack of water.

Treatment.—Indications for treatment are to administer a sufficient amount of water, to stop the diarrhea, to correct the acidosis, and to administer sufficient food to build up the tissues destroyed. The indication for water is immediate. The desiccation of the blood and body fluids accounts for most of the urgent symptoms which threaten life. Furthermore, if such desiccation continues for any length of time a destruction of body cells occurs which may be so extensive that no type of treatment is availing. To supply water the infant was offered water at very frequent intervals, but there seemed little prospect of introducing a sufficient amount of water in this way to overcome the loss of water from the body within a reasonable time. Water was, therefore, administered intraperitoneally. In order to prevent damage an isotonic solution must be used. Normal saline is satisfactory, but Ringer's solution is preferable on account of the calcium and potassium salts which it contains. Such a solution in part makes up for the loss of these substances by the diarrhea—350 c.c. of Ringer's solution were injected into the peritoneal cavity of this infant. The fluid was sterilized, cooled to body temperature, and injected with all aseptic precautions. This fluid was completely absorbed within seven hours' time, and a second injection of 400 c.c. of Ringer's solution was given.

The acidosis of a patient such as this might be expected to disappear after a sufficient amount of fluid had been administered

to restore the blood volume and to permit of renal activity. In this patient, however, the acidosis was so severe as to seriously threaten life; for this reason it was essential to correct the acidosis as soon as possible. To this end 40 c.c. of 4 per cent. sodium bicarbonate were injected slowly into the superior longitudinal sinus. The bicarbonate solution was prepared by dissolving sodium bicarbonate in freshly distilled water at body temperature. The solution was not subsequently heated, as the heating would result in breaking up the bicarbonate. Such a solution may be safely injected, as it has been repeatedly shown to be aseptic on account of the bactericidal action of the bicarbonate. In addition, 15 grains of sodium bicarbonate were given by mouth every two hours. This dosage was kept up for two days. In order to temporarily increase the blood volume, to bring about diuresis, and to supply a quickly available food, glucose in 10 per cent. solution was administered intravenously. Of this solution 50 c.c. were injected the first day. The injection was made into the superior longitudinal sinus, the fluid was run in very slowly, twenty minutes being taken for the amount injected. Twelve hours later the injection was repeated.

The effect of the treatment instituted was satisfactory. The administration of fluid prevented further weight losses. The normal water content of the blood was restored, as shown by the fact that the blood protein content, which was 8.6 per cent on admission, had fallen to 6.8 per cent. within twenty-four hours, 6.2 per cent. the following day, and finally, on the third day, to 5.47 per cent. This restoration of fluid to the blood with consequent increase in blood volume resulted in a definite increase in the volume flow. This increased from 3.4 c.c. on the first day to 8.9 c.c. on the third day in the hospital. Coincident with this the blood-pressure rose to 80 millimeters systolic and 55 millimeters diastolic. As the result of a sufficient supply of water the temperature fell to normal and remained essentially normal for the remainder of the time the child was in the hospital. The administration of fluid and alkali resulted in a complete disappearance of the symptoms of acidosis, and the blood

bicarbonate content rose on the second day in the hospital to 56.9 volumes per cent.

With a restoration of a better blood flow throughout the body the color improved. There was evidence of more normal functional activity of the heart muscle, for an electrocardiogram made three days after admission showed QRS complexes of normal height, a positive T wave in leads I and II, and a P-R interval of 0.110. A tracing entirely normal.

The treatment so far considered in this infant was directed toward a restoration of the normal physiology of the body. Such restoration of normal conditions would have but a temporary effect unless the diarrhea ceased, and unless a sufficient amount of food were administered to the infant to build up the tissues destroyed. In an infant of this type the administration of an ordinary milk mixture almost invariably results in an increase in the diarrhea. At the same time a prolonged period of starvation or underfeeding results in further destruction of body tissue. We are, therefore, confronted with the problem of giving a considerable amount of food to an infant with a very intolerant gastro-intestinal tract. Our choice of food for such an infant is limited. Protein milk may be taken in small amounts without leading to an increase in the diarrhea, but protein milk without added sugar cannot be fed to such an infant for any length of time without serious impairment of the nutrition. Breast milk meets the demands as far as food value is concerned, but the feeding of breast milk to such an infant usually results in the continuance of the diarrhea. Breast milk which has been converted into lactic acid breast milk by inoculation and incubation with a pure culture of such lactic-acid-producing organisms as the Bulgarian bacillus may be taken in considerably larger amounts without increasing diarrhea than can sweet breast milk; but such milk is often excessively acid and leads to vomiting. To overcome this difficulty this infant was fed on a mixture of equal parts of lactic acid breast milk and unchanged breast milk. This was given in amounts of $2\frac{1}{2}$ ounces at four-hour intervals. The effect was satisfactory. (See Fig. 71.) The stools diminished in number, so that it was felt advisable to increase

ST. LOUIS CHILDREN'S HOSPITAL
NAME Hall M, F
NO. 15063
Age
Date
Weight
Temp. F. C.
(WEIGHT)
(TEMP)
Calories
Intake
Food H2O
Vomiting
Stools
Day
Night
3 mos.
22
23
24
25
26
27
28
29
30
31
1
2
3
4
2900
2800
2700
2600
2500
2400
106 41
105
104 40
103
102 39
101
100 38
99 37
98
97 36
96
95 35
Total
Per Kilo
BM 270
6 X 90
WLM 270
SLM 210
K.S. 60
6 X 90
WLM 300
SLM 180
K.S. 60
6 X 90
9 A.M. 90

Fig. 71.

the amount of food to 3 ounces at a feeding. This supplied the infant with a total of 150 calories per kilo and the diarrhea was not increased. Subsequently the infant was changed to a cow's milk mixture of the following composition:

Whole lactic acid milk	9 ounces
Skimmed lactic acid milk (buttermilk)	7 "
Corn syrup solution (50 per cent.)	2 "

Six feedings of 3 ounces each.

Experience has shown that such a milk mixture is much better tolerated by these infants than a sweet milk mixture. Corn syrup was added instead of other forms of sugar, as this contains such a large proportion of the non-fermentable dextrin that severe gastro-intestinal symptoms do not occur.[1] This feeding was subsequently increased in caloric value by increasing the proportion of whole lactic acid milk, so that the formula two days later was:

Whole lactic acid milk	10 ounces
Skimmed lactic acid milk	6 "
Corn syrup solution (50 per cent.)	2 "

Six feedings of 3 ounces each at four-hour intervals.

This supplied a total food value of 150 calories per kilo. On this form of feeding the weight increased satisfactorily. The stools were semiformed, yellow, and pasty. This feeding is at present being continued. The infant is gaining weight at a good rate and her clinical condition is, in general, excellent. The gain in weight is not due to edema.

The treatment instituted in the case of this infant was successful because it was begun before serious damage to the body cells had occurred. If delayed for even a few hours it is extremely doubtful if this treatment would have accomplished more than temporary clinical improvement.

In any infant with a gastro-intestinal disturbance the aim of treatment must be to prevent loss of water and destruction of body tissue. When these two serious consequences have oc-

[1] For details regarding this type of feeding see Jour. Amer. Med. Assoc. Oct. 18, 1919, vol. lxxiii, pp. 1173–1175.

curred the immediate indication is to supply food and water in whatever way this is possible.

Subsequent Note.—The infant was discharged from the hospital at the end of seventeen days and was fed on a similar type of formula at a feeding station. The infant did well, had no digestive disturbances, and made an average gain of 1 pound a month.

CLINIC OF DR. BORDEN S. VEEDER

(Clinic on Normal Feeding at Municipal Welfare Conference), Washington University Medical School

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COMPLEMENTAL BREAST FEEDING

At our last conference we were discussing breast feeding and its technic, and I told you that almost without exception every mother is able to nurse her baby. For purposes of propaganda we often say "every mother can nurse her baby," as one of the chief factors leading to the starting of artificial feeding is the psychic condition of a mother who despite the desire for maternal nursing has the fear that she cannot nurse her baby. The best galactagogue is a combination of a fixed idea in the mother's brain that she is able to nurse her baby together with the stimulus of the baby on the breast. We must recognize, however, that (1) there are certain pathologic conditions, uncommon to be sure, as active tuberculosis on the part of the mother, which contraindicate maternal nursing; and (2) instances where the breast milk is insufficient to furnish enough food for the baby to gain and thrive properly.

I have here this afternoon baby B., who is an example of this last type. Mrs. B. brought this baby into the feeding conference some eight weeks ago, at which time the baby was six weeks old. The baby at this time weighed 7 pounds, 14 ounces. Now Mrs. B. claimed the baby had weighed 8 pounds when it was born, but had never gained, although she had fed it regularly every three hours on the breast. It was a fairly happy baby, though was not fat like her neighbor's baby. We had Mrs. B. nurse the baby, then weighed it again, and found that the baby had taken only 1½ ounces from the breast in twenty

minutes, and yet the breast seemed quite empty. To shorten the case history, we found that the mother had been and still was very anxious to nurse her baby, but as the baby failed to gain weight she was torn between this desire and the desire to give up the breast for "Eagle Brand," which had made her neighbor's baby fat. She was quite sure that her milk was not agreeing with the baby, and this was the reason for the failure to gain.

We explained to her the advantages to the baby of breast feeding, and persuaded her to go home and nurse the baby regularly every three hours, and to return in a week, promising that if the baby had not gained during this interval we would either change the food or give it more to eat. Then a nurse went round to the home and reassured the mother and took up the question of the mother's diet, which, by the way, was satisfactory.

One week later the mother brought the baby back; it weighed 7 pounds, 15 ounces and had gained exactly just 1 ounce. Again we weighed the baby before and after nursing, and found that it had only taken 2 ounces at the nursing. There had been no vomiting and the stools were good. Certain deductions were obvious. With proper nursing technic and satisfactory maternal conditions the baby had obtained from the breast enough food to hold its weight, but not enough food in addition to gain upon. The indication, however, was not to stop breast feeding and start artificial feeding. Because the supply of breast milk was insufficient the indication was simply that some food must be given in addition to supply the needs and requirements of the child. Laboratory analyses of the breast milk to determine its quality were not made because they are of no practical value. What was done was to instruct the mother to nurse the baby regularly every three hours during the day and once at night. After the six day nursings she was to give the baby a bottle containing 1½ ounces of the following mixture:

Boiled milk	6 ounces
Boiled water	6 "
Cane-sugar	1 rounded tablespoonful

The caloric value of the total mixture being about 200, the baby would get approximately 150 calories additional a day if it took 1½ ounces of the mixture after each nursing. We instructed the mother to let the baby take as much of the 1½ ounces as it desired after it had nursed from the breast.

The mother brought the baby back the next week and the weight was 8 pounds, 5 ounces—a gain of 6 ounces. Ever since the baby has gained satisfactorily. Some two weeks ago we permitted up to the entire formula, that is, 2 ounces of the mixture of half milk after each day nursing. As a rule, the baby has taken the entire feeding and has only occasionally rejected a little. There has been no vomiting, showing that the total quantity of fluid of the combined breast and mixture was not too great for the child. The stools have been good, and, as I said, the gain has been steady. The baby is now a little over three months of age and weighs 10 pounds, 4 ounces, or approximately has made a gain of 5 ounces a week since the additional food was started. This last week the gain has been a little slow and we are jumping the formula to 3 ounces of half milk after each nursing, adding 1 ounce of sugar to the total mixture of 18 ounces. Although we have not estimated the amount of breast milk which the baby has been getting since the complemental feeding was started, I am quite sure that there has been a distinct increase in the amount of breast milk secreted. Now that the baby is gaining the mother is quite happy and contented, which would tend to increase her milk supply, and, moreover, it is questionable whether the baby would have made such a steady gain or made so large a total gain from the amount of additional food. The baby has done very much better on the combination than we could possibly have expected had artificial feeding been given alone. As you look at this baby today you see she is plump, happy, and contented, the skin is clear, and the muscles are firm to the touch; in fact, she has all the physical attributes of a breast-fed baby.

It is always a matter of surprise to me how little attention is paid to this question of mixed or complemental feeding in our text-books of nutrition and infant feeding. As a rule, you will

find that it is only briefly discussed, and then usually in connection with weaning. As a matter of fact, it should never be included with the discussion of weaning, as we use it for almost diametrically opposite purposes. Practically it is of decided importance, and it is a method of feeding which is becoming more and more used in this country, hand in hand with the campaign for breast-fed babies. In a survey of some 1500 babies attending our Welfare Conferences in St. Louis this last year we found that approximately 75 per cent. were breast fed, 10 per cent. were fed on breast milk plus some additional food, and only 15 per cent. on strictly artificial feeding (cow's milk or proprietary foods). We are more and more learning the value of eking out mother's milk or supplementing it with cow's milk, and I am sure that had a proper attempt been made in early infancy a large number of the babies who are now on entirely artificial feeding could have been kept on a partial breast food.

As you know, the campaign to reduce infant mortality has led to a decided increase in breast feeding and to better and simpler methods of artificial feeding. We have gone over the advantages to the infant of mother's milk—not only does it show grossly in the tremendous difference in the mortality between the breast and artificially fed infant, but those of us doing children's work recognize the tremendous difference in the physical well-being, the resistance to infection, etc., of the breast-fed child. This I have gone into in detail at a previous conference and will not repeat. We have also found that if an infant is but partially fed on the breast, these same advantages are in a large measure obtained. Just what percentage of breast milk to the total quantity of food ingested is required to bring about all of the attributes of the totally breast-fed infant is not known, but we do know that even a small fraction is seemingly of tremendous advantage and importance. A striking example of this I saw in the case of Baby L. Mrs. L. had previously had 3 children, all of whom had been guided through infancy with the greatest of trouble and all of whom had been bottle fed, as Mrs. L. had never had any milk after her babies were a week or two old. When the fourth baby was born the milk

began to disappear at the end of the second week, but by persistent effort—and the mother was very anxious to nurse her baby because of the difficulties she had had raising the others on the bottle—we found that we could keep up about 6 ounces of breast milk a day. This was done faithfully by the mother, who nursed the baby every three hours until the baby was six months of age. This last child was the only baby with whom the mother did not have a great deal of difficulty, and I feel that we can attribute the difference to the small amount of breast food which the baby received. The amount of breast milk was always too small to have been much of a factor in furnishing sufficient calories, but what it apparently did was to furnish sufficient vitamins or whatever the live active principles of mother's milk may be which are seemingly so needed in the proper upbringing of the infant.

Mixed or complemental feeding should not be instituted too hastily, that is to say, never unless we are absolutely sure that the mother is not furnishing enough milk. Failure to gain for a single week is by no means an indication for supplementing the breast. It is not at all uncommon to see a baby who fails to gain for one week or even two make a decided gain during the following week. When the baby does not gain for several weeks on the breast, despite a proper régime on the part of the mother and proper breast feeding technic, the time has arrived when complemental feeding must be considered. The first step is to determine whether or not the baby is getting enough food by weighing it before and after nursings, and this should be done in every case. I am taking it for granted that methods of increasing the flow of milk through proper diet, exercise, and the stimulation of nursing have been undertaken. Having once found that extra food is needed, it is best to start with the addition of from $1\frac{1}{2}$ to 2 ounces of an artificial mixture following each day feeding. The mother should be told to nurse the baby every three hours, alternating the breasts and allowing the baby to nurse for about fifteen minutes. Because of the stimulative effect of nursing on the secretion of mother's milk I prefer three-hour periods in these cases rather than four hours.

After the nursing the bottle should be offered. I have found that this is very much preferable to the system used by some of alternating breast feedings with bottle feedings, although this may be more convenient for the mother. This alternate method is termed "supplemental" by some in contrast to the "complemental" feeding, which term is used to indicate the following of the breast by the bottle. As we have said, this alternating the breast with the bottle has a tendency in itself to lead to a decreased flow or secretion in the amount of mother's milk. It is the method to be followed in weaning, but not the method when you wish to keep up as much breast milk as possible. If after a week it is found that the baby does not gain upon the small addition of food, the amount or the strength of the complemental feeding should be increased. If it has been found that the baby has gained 4 or 5 ounces during this week the amount of additional feeding should not be increased, as again and again I have seen complemental feeding instituted with the result that improvement in the baby led, in turn, to the quieting of the mother's anxiety and fears, and this, in turn, led to an increased secretion of milk. In a number of these cases after three or four weeks it has been possible to do away with the additional food entirely, and the mother has been able to go on nursing her baby throughout the rest of infancy without the aid of other food. If the child fails to gain, the amount of complemental food must be increased interval by interval until results are obtained.

Very often the mother asks the question how long must she go on nursing the baby and at the same time giving the bottle. That is to say, how long before she can give it the bottle alone. As we have gone into the subject before, the first three months of infancy forms the dangerous period in the infant's life so far as nutritional disturbances are concerned. Therefore, I feel that every effort must be made to keep up even the smallest amount of breast milk during these three months, and I personally make every effort to keep up the mixed feeding until six months. After six months it is questionable how much is to be gained by mixed feeding unless a very large portion of the total

quantity is obtained from the breast. Certainly, however, if only a small part of the child's food has been obtained from the breast up until this time we have done a great deal for the infant.

Mixed feeding is also extremely valuable in those cases where there is an abscess of the breast or some trouble with the nipples so that the child cannot obtain enough maternal food to thrive. Very often in these cases a temporary complemental feeding will carry the baby along during its early infancy until the nursing difficulties have been overcome, and from then on the baby will go along on the breast alone.

As you will note, I have prescribed cow's milk for the complemental feeding. As a matter of fact it is probable that almost any type of artificial food, including dried milks, condensed milks, proprietary foods, etc., could be given without in any way injuring the infant. There is going to come a time, however, when the infant will be artificially fed entirely, and if proprietary foods are started as the complemental food it will undoubtedly end in these being used when the baby is artificially fed. For these reasons it is best to start as a complemental food that food which we desire to give the baby when artificial feeding is inaugurated, and almost without exception cow's milk should be the basis of the artificial food.

If you will go back over your histories of the infants who have been placed upon proprietary artificial foods you will find that as a general rule the reasons for the change from the breast has been a failure to gain in weight. The cause of this failure is usually ascribed by the mother to some lack of quality in her milk rather than to a lack of quantity. It is deplorable, moreover, how many of these cases come to us in which this same statement has been made by the doctor. I cannot impress upon you too strongly that the failure is practically never in the quality of mother's milk, but in the quantity. From a practical standpoint analyses of the quality of mother's milk are useless. As a matter of fact, as we have said, the difficulty in these cases is practically always due to an insufficient milk supply, and by proper nursing intervals, proper diet on the part of the mother, proper rest, proper nursing technic the amount of milk could have

been increased in the majority. In practically every one of them, taking for granted that sufficient mother's milk could not have been obtained, I feel sure that had complemental feeding been started the baby would have been able to obtain some mother's milk for a number of months and that the feeding difficulties for which the infants were brought to the conference would have been avoided.

CLINIC OF DR. JOHN ZAHORSKY

ST. LOUIS CITY HOSPITAL

TWO CASES OF INFANTILE DIARRHEA

Importance from a Prognostic and Therapeutic Standpoint to Make a Clinical Distinction Between an Enteritis and a Functional Disturbance. Methods for Making a Differential Diagnosis. Full Discussion of Treatment for Both Types of Cases.

THERE are in the ward several infants suffering from acute digestive disorders, but I will present only two, as they are representative cases of what is commonly termed "summer diarrhea."

CASE I.—C. P., boy, fourteen months old. Admitted to hospital after two days' illness.

Mother has two other children, both of whom are healthy. A fourth infant died of an acute nephritis two years before. Father and mother healthy. No acute illness in the family.

Our little patient was naturally fed until he was eight months old. Since then he was given a rational mixed diet. Three days before the onset of the illness the mother gave the baby a teaspoonful of ice-cream bought at the corner drug-store. She had always boiled the baby's milk.

The present illness began with vomiting two days ago. About the same time the bowels became very loose. The infant had one thin stool about every hour for six hours, when suddenly he was seized by a severe convulsion. A physician who was called found the temperature 102° F. The fever persisted until the following day. The vomiting had ceased, but the diarrhea continued. Some diluted milk was given two or three times yesterday, but the baby would not take very much. He cried with pain a few times.

Present condition: Infant well nourished, weight 21¼ pounds. The baby lies in a somnolent condition, eyes appear sunken, fontanel depressed. The skin is dry and pale, but elastic. The mouth appears dryer than normal. The mouth shows six teeth. No ulceration found in the mouth; gums are not hemorrhagic. The throat is somewhat congested, tonsils are small. No glandular enlargement is to be made out.

Physical examination of the heart and lungs reveals nothing abnormal. The abdomen is flat, no tenderness can be made out. Liver not enlarged, spleen not palpable. On inspecting the abdomen carefully characteristic shadows of intestinal hyperperistalsis can be seen.

The buttocks are considerably reddened, especially about the anus. No marked rachitic changes are discovered. The nervous system shows nothing wrong. The pupils are large, but react to light promptly. No rigidity of the neck is present. Brudjinski and Kernig's signs are negative; Chvostek absent. The superficial and deep reflexes are somewhat increased. The temperature is 99.8° F. The respirations are not deep or hurried. Pulse strong. The urine has not been examined. The blood reveals a leukocyte count of 12,000. The polymorphonuclear cells are relatively increased (52 per cent.).

The stool obtained with a rubber tube is thin, very watery, and spurts through the tube. It is yellowish green in color and fairly uniform in consistency. No blood or large mucous masses can be made out. Under the microscope the stool shows thousands of round cells, leukocytes, and lymphoid cells in each drop. Small shreds of mucus are also present.

CASE II.—C. W., female, five months old, was breast fed until one month ago. The baby has screaming spells, strains hard at times, and passes gas. Diarrhea, eight to ten stools daily, began two days ago. The infant has lost in weight. No fever has been observed. No vomiting occurred. The infant's diet in the last month consisted exclusively of malted milk, except the last three days, when a little boiled cow's milk was added to the malted milk. As the baby seemed hungry it was fed 6 ounces every two or three hours.

Present condition: Pale, thin-looking infant, weight 13 pounds, 5 ounces. Baby looks bright, but not happy. Skin dry, but elastic. Tissues flabby, turgescence reduced. Respiration normal, temperature 99.1° F. Eyes appear sunken, the fontanel is depressed. Heart, lungs, and abdomen show nothing abnormal. The mucous membrane of the mouth is moist, but appears congested—no teeth. The nervous system shows nothing wrong. Bones appear normal. No craniotabes. The buttocks surrounding the anus are reddened, and on one side of the anus a large excoriated area is present. The urine was not examined. The blood shows no change. The lymphocytes are relatively larger in numbers.

The stool obtained with a catheter is thin, yellow, and contains visible mucus. Microscopically, only a few round cells are seen, 4 or 5 to each field. The stool has a sour odor; 2 grams of diluted stool require 1.9 c.c. of decinormal soda solution to be made alkaline, phenolphthalein as indicator.

It is obvious that in many particulars the clinical symptoms in both cases are similar. The acute onset, with vomiting, the watery diarrhea, the irritated buttocks, the rapid loss in weight, and the irregular temperature are symptoms common to both. On the other hand, there are certain differences:

In the first case the mother observed high fever on the first night. This was not noticed in the second case. A relative increase in the polymorphonuclear cells was discovered in the first case, but not in the second. Finally, an enormous number of cells are found in the stools of the first infant.

The clinical diagnosis in the first case, then, is an enteritis, an inflammation of the lining of the intestines. In the second case we have no evidence of an actual inflammation, merely an irritation of the buttocks and presumably also of the intestinal tract. We might speak of it as an irritation of the intestinal mucous membrane. Clinically, we place this disease under the name "fermentative diarrhea," signifying a functional disturbance.

It is exceedingly important, both from a prognostic and therapeutic standpoint, to make a clinical distinction between an enteritis—*i. e.*, an actual inflammatory change in the in-

testinal wall—and a functional disturbance. The first is probably due in all cases to a penetration of pathogenic bacteria into the intestinal mucosa and solitary follicles, and we have the familiar phenomena of bacterial infection of a mucous membrane. There is at first a redness and swelling of the intestinal lining, accompanied by a serous discharge. This discharge becomes thicker and mucous in character and with it an enormous emigration of leukocytes. The virus (probably always bacteria) is usually carried to the solitary follicles, which, as other lymphoid tissue, have as one of their functions the cleansing of the mucous membrane. No doubt much of the virus is destroyed in these glands, but if the bacteria are virulent an adenitis results, the follicle swells and finally bursts, and the contents of the follicle, bacteria, bacterial products, leukocytes, and lymphoid cells, are discharged into the intestinal canal. We must regard this as a natural method of ridding the organisms of infectious material. It is one method of resistance to bacterial invasion. If the invading bacteria are not numerous, only a few follicles may be implicated and the disease is mild; if there is a very extensive involvement of the intestine, the disease becomes very severe.

Now these changes in the intestinal wall can be fairly well studied by noticing the cells in the stools. Let me say parenthetically that the study of the cells in the stools of infants has not received the attention which it deserves. The presence of an enormous number of cells in the stools in the enteritides of infants was demonstrated long ago by Raudnitz. Monti also called attention to these cells. But for some reason, not clearly understood, these studies received no attention by the practical pediatrists, and the description of the stools usually found details the presence of blood, mucus, and sometimes macroscopic pus, but no mention is made of cells.

I have suggested a very simple test, which has been found very valuable in differentiating the true enteritis from functional diarrhea. A fresh sample of the stool should be obtained by means of a catheter. The stool obtained may be only a little mucus in the eye of the catheter; or, as in this case, you

see more than a teaspoonful of watery stool which runs through this short tube into a dish. This liquid stool is greenish in color, full of particles, but the striking feature is the watery character of the stool. This fluid nature cannot be appreciated by merely inspecting a diaper, since the fluid is rapidly absorbed by the cloth. In your office and private practice do not be content merely in examining a diaper which the mother has laid aside for you. Use a catheter and get a sample of a fresh stool.

With a dropper 1 drop of the stool is placed on a glass plate (a slide will do), and beside this 2 drops of water are deposited. With a probe or wooden applicator the stool is thoroughly agitated with the water. The larger particles are then pushed to one side, and you see here at the edge of our water-stool mixture a fairly clear part. This drop is taken up by means of a medicine-dropper, placed on a slide, and examined with a dim light directly under the low power of the microscope. As you see, there are hundreds of cells in each field.

These cells are composed mostly of leukocytes, but you notice in every field also 8 or 10 large mononuclear cells, the lymphoid cells of the lymph-glands or solitary follicles.

This particular method of examination is superior to the staining method, since these degenerate cells do not stain well. Cleansing the stools with ether and acid alcohol and the use of the centrifuge tells us no more than this simple inspection.

We will now obtain a stool from the second case. You notice also that the stool is watery, but not quite so thin as in the first case. It is more yellowish, however, and seems to have more mucus. When diluted and examined under the low power of the microscope very few cells are seen—4 or 5 cells to the field is all that can be made out. In one case we see hundreds of cells in each drop, in the other almost none. It is this difference which is so striking in the majority of cases that establishes the diagnosis.

The presence of so large a number of lymphoid cells in the stools of the first baby demonstrates an extensive involvement of the solitary follicles. Hence it is termed "follicular enteritis" —not that the follicles only are affected, the epithelial lining is also implicated in the inflammatory process, but the follicles show the greatest reaction.

Another difference in the history of the two cases is that high fever was observed in the first infant. Personally, I have been convinced that the only cause of fever that has any importance to the practising physician is an infection. A great deal has been written about sugar fever, salt fever, etc. Slight fluctuations of the temperature occur in all sick babies, but these subfebrile movements are not fever in the clinical sense. Excluding the rare cases in which an excessive heat and diminished water-supply produce a thermic fever, an acute fever at the onset of a gastro-intestinal disturbance means an infection, a penetration of bacteria into the mucous membrane. The more I study these cases the more convincing is the evidence that the so-called gastro-enteric intoxication with high fever is very rare. Several times a diagnosis of gastro-enteric intoxication was made, but the presence of mucopus was found in the stools two or three days later.

Another difference was the relative increase in the polymorphonuclear cells in the blood. This, too, is of some value in determining whether an infectious process is present or not. There may be no leukocytosis, but yet there is a relative increase in the polymorphonuclear leukocytes. The great difficulty in estimating the value of this sign is that infants at different ages show such great variations in the relationship of the different forms of leukocytes even in health.

Having made the diagnosis, let us try to conceive of the course of these diseases. In the first case the body is combating an infection that is mobilizing its resisting forces, cells, leukocytes, and antibodies. At the same time the digestion and absorption of food is terribly deranged. Peristalsis, at least in the inflamed parts, is excessive and the food is hurried through the alimentary canal. In addition, mucus, lymph, and cells are discharged into the mass. It is no wonder that putrefactive and fermentative processes become active. Every case of enteritis, however mild, results in a fermentative diarrhea. Strictly speaking, there is no difference in the digestive disturbance in a functional disturbance known as fermentative diarrhea and an inflammatory process, or enteritis. It is the decomposition of

food residues in both instances which cause most of the alimentary disturbances, and the secondary nutritional disorders. But the destruction of the infection and the healing of the inflamed parts takes time, sometimes a long period. Hence, the diarrhea of enteritis is protracted, while the diarrhea in the fermentative type usually ceases abruptly when the diet is changed. Only in young infants with a very extensive irritation of the intestines does the prognosis become doubtful. Do not forget that in either case the diarrhea, by the excessive loss of water and salts, may lead to the syndromes of dehydration and acidosis.

There is still much confusion in the descriptions of the symptoms and in the explanation of the internal process of the toxic conditions which accompany or follow diarrhea, but a few facts have already become generally appreciated:

First: The infant may lose so much water that the tissues become dehydrated. The blood volume becomes reduced and the blood solids increased in their concentration. This is known clinically by the sunken eyes, the dryness of the skin, the inelasticity of the skin and subcutaneous tissues, and by muscular hypertonia.

Second: There is an excessive loss of alkalis, especially sodium and potassium. This may lead to a diminution of the alkalinity of the blood and the symptoms of acidosis appear. These are hyperpnea, somnolence, and great prostration. The peculiar staring expression of the sunken eyes may occur in dehydrated infants and is not necessarily charactersitic of an acidosis.

Third: There is the loss of lymph and cells, a great protein and ferment loss. Just what part this plays in the expression of the disease is uncertain, and yet it should not be underrated.

Finally, in all infectious enteritides we must remember that the toxin of the infective agent produces symptoms of fever, prostration, convulsions, etc. It is often impossible clinically to state that a convulsive seizure is due to the toxin of the infectious agent, to dehydration processes, or to demineralization. We cannot always separate these groups of symptoms.

In the cases under consideration no marked nutritional

changes are as yet discernible. We trust that by the institution of proper treatment any serious alteration of the tissues may be avoided.

There is scarcely any disease which offers such complicated problems for solution as the treatment of an infectious enteritis. The first question that offers itself is, What can be done to destroy the micro-organisms in the follicles? The value of the so-called intestinal antiseptics is now generally discredited. The agent is yet to be found which will inhibit the growth or destroy bacteria in the intestinal mucosa and do no harm to the body. There are, however, certain drugs which inhibit bacterial activity in the intestinal contents, thereby diminishing intestinal fermentation. Of the many that we may select, the bismuth salts are still the most widely used. Many simple fermental processes, even without a change of diet, may be stopped by giving some internal antiseptic. Even in an infectious enteritis the administration of an antiseptic may enable us to increase the protein content of the food. There is no doubt that the best way to diminish the intestinal fermentation is to clean out the intestinal canal with a purgative or flushing out the colon with water (enteroclysis) and starve the patient, but as the starvation can be continued only a few hours, we sometimes can get assistance from intestinal antiseptics. But the drug must be selected with care; we must not poison the patient.

What can we do to increase the patient's resistance? Since the bacteriology of the infectious diarrhea is still in dispute, no effective antitoxin or bactericidal serum has been offered. Immunization by means of bacterins is still in the experimental stage. In severe cases the intramuscular injection of blood or blood-serum obtained from a parent or any healthy person seems to be of great service.

We must almost entirely depend on the natural resistance of the baby to overcome the disease. We insist on rest in bed, making the baby comfortable, and "mothering" it. There can be no doubt that the death-rate of enteritis is enormously increased if you take the baby away from its mother or the nurse to whom it is accustomed.

Cool sponges in the hot weather are very helpful. I often advise that the baby be kept in the basement on hot days.

In the acute stage the withdrawal of food for a few hours is necessary, but water must be continuously supplied. Water supplied by the natural route is to be preferred. Occasionally on account of a very irritable stomach all fluid is vomited and water must be supplied in some other way. The subcutaneous, intravenous, or intraperitoneal injection of Ringer's solution may be resorted to.

In order to prevent the development of an acidosis, alkalis should be given early. Sodium citrate or sodium bicarbonate should be given several times a day. These alkalis may, however, be supplied by giving a little orange juice, or a decoction of vegetables and potatoes (vegetable soup) several times a day.

After a few hours of starvation food must be slowly administered. What is needed first are the carbohydrates. Slightly sweetened cereal decoctions or, still better, thick cereal gruels. At first only a small quantity is given, but the dose is rapidly increased by the second or third day. As this infant is fourteen months old and has been digesting starchy foods, there should be no difficulty in giving him a maintenance ration of thick cereal gruels after two or three days. I change the cereals every day, or sometimes several times a day. For this infant the following diet will be prescribed:

6.00 A. M.: 4 ounces of cream of wheat or farina mush with sugar.
8.30 A. M.: Tablespoonful of orange juice.
9.00 A. M.: One slice of bread slightly toasted and soaked with weak tea —sugar.
12.00 M.: 4 ounces of cream of wheat.
3.00 P. M.: 4 ounces of rice gruel.
6.00 P. M.: Toasted bread and tea.
10.00 P. M.: 4 ounces of rice gruel.

The treatment of enteritis with cereal gruels is the safest. The cereals do not readily undergo excessive fermentation. They favor the retention of water in the tissues, and they furnish salts and a small quantity of protein substance. Even a small quantity of milk added to the cereals will greatly increase the tendency to intestinal fermentation. It is best to wait a few days until the

intestine has healed somewhat before any milk or other food containing protein is added. I prefer to take out one meal, say at three in the afternoon, and substitute a protein diet for this. Buttermilk is a good substitute, better than broth, white of egg, or beef juice. In greatly weakened conditions of the intestinal tract this alternate method of feeding presents advantages. At one time we given protein substance, at another time carbohydrates. Fats are not essential except in small quantities in feeding the sick child.

No medicine need be prescribed for this infant at present. We will, however, direct the nurse to give 10 drops of paregoric once or twice at night if the baby is very restless and does not sleep.

The treatment for follicular enteritis resolves itself into careful feeding and nursing. The functional disturbances of the body, whether of the stomach, intestine, nervous system, etc., must be anticipated, if possible, and prevented. It is a serious mistake to produce vomiting by overdrugging, to produce intestinal stasis by giving too much opium, to increase intestinal fermentation by giving a fermentable food mixture in too large a quantity, or to permit the appearance of exsiccation or acidosis. In no other disease are the requirements for successful treatment so dependent on the physician foreseeing things.

A few words in regard to the treatment of our second case. The common treatment of starvation for twenty-four hours and a gradual restitution of a diet to normal covering a period of several days is usually successful. This baby, however, is in a starved condition; it will be safer, therefore, to put it at once on a maintenance ration of a food which does not undergo acid fermentation readily. We will prescribe the following:

20 ounces of fermented milk.
10 ounces of barley-water.

This contains about 250 calories, which gives a ration having an energy quotient of 60 calories. We will keep the baby on this mixture until the stools are normal, when sugar should be added gradually until a percentage of 7 or 8 is attained.

CLINIC OF DR. CHARLES HUGH NEILSON

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FEVER IN GENERAL, WITH SPECIAL REFERENCE TO SLIGHT ELEVATIONS OF TEMPERATURE AND THEIR CLINICAL SIGNIFICANCE

FEVER was one of the first symptoms recognized and studied in the field of medicine in the historic past. The "old masters" theorized concerning it, discussed it, and wove about it many and fanciful beliefs. Their crude methods of measuring the temperature led them into error. The then little known and meagerly developed sciences of physiology, chemistry, and metabolism had not been considered as basic principles in the cause and development of the fever. The present-day facts concerning infection and bacteria were an unknown and uninvestigated field. In the course of time we came to the discussion and rivalry between Liebig as a chemist and Pasteur as a vitalist. This was the dawn of the modern investigation of fever, and the sunrise followed when Pasteur enunciated his beliefs, which resulted in the science of bacteriology. Since that epoch a host of workers in every branch of the so-called fundamental sciences of medicine have added this fact and that fact, until our modern conception of fever has been evolved.

What, then, is the present-day status concerning fever? In attempting to answer this question we will first direct our attention to a discussion of the infections.

We know that most, if not all, of the infections in the period of invasion and in their full development show a common result, namely, fever. This reaction is due in part to the absorption of bacterial products, chemical in nature, and in part to an alteration in the heat-regulating apparatus. The absorption of these chemical substances probably causes increased heat production.

A dogmatic statement that fever in the infections and fever in general is due to an increased heat production rather than a decreased heat loss, brought about by a disturbance in heat control, is probably justifiable in some cases, but not in all. If we take it for granted that fever in the infectious diseases is an increased heat production, what is the nature of the substances that bring this about? They are probably protein substances produced either by the growing and multiplying bacteria which we may call toxins, or by protein substances from the bodies of the bacteria themselves. There is also the probability that cell destruction in the body may furnish its quota of protein substances. The identification and isolation of these substances is next to impossible. Reasoning from the fact that the injection of known proteins produce febrile reactions in man and animals, although the mechanism is unknown, we may reasonably say the same thing holds true for infectious processes. It is a fairly well-established fact that heat production is increased during the invasion and full development of a microbic disease. This has been estimated to be an increase of 20 to 30 per cent. Later in the course of the disease or in the long-continued fevers this may be materially lessened or even absent. The continuance of the fever in this case may depend on a decreased heat loss. The next ten years ought to give us much accurate information on this point. The modern quantitative chemical methods with workable metabolic apparatus open up possibilities of study which may be most fruitful. The work of DuBois, Benedict, and many others has already given us much valuable information.

Let it be granted that heat production is increased in infectious fevers due to a protein absorption. What and where is this increase?

An increased protein metabolism probably takes place in fevers. This is very likely due to the stimulation caused by the so-called toxic substance, but the fever itself may be a cause of rapid protein change. In many cases the rate of protein metabolism and the fever run parallel. In others this does not hold. The mere statement that the rate of protein change is increased does not explain all. The fact that some fevers show but little

change; that the end-products, such as albumoses, peptones, amino-acids, etc., do not appear materially changed from the normal, demand a close study in the future. This protein change probably takes place in muscles, glands, and body fluids.

The metabolism of the fats and carbohydrates is practically unknown. The most available supply of carbohydrates, namely, glycogen, quickly disappears. The body fat also disappears, due either to an increased metabolism by the fever or due to inanition, since the food intake is usually low. The normal or often low respiratory quotient is difficult to explain. If we grant that fever is caused by toxic agents producing an increased body chemistry with resultant increased heat, how can we explain the following facts? In severe exercise much more heat is often produced than in fever subjects and yet the temperature does not rise. The ingestion of large amounts of protein produces more heat than in fever, but there is no rise in temperature. The metabolic rate in hyperthyroidism is often 50 to 80 higher than normal, and often only a slight fever results.

It seems the heat-regulating apparatus may be an important factor in the control of body temperature. Is there a decreased heat loss in fever? No trustworthy evidence seems to be known on this point, but it may be safely assumed, from the dry skin, the blanched capillaries, that heat loss is decreased. This condition is just opposite in crises, where the temperature falls and the skin is moist and red. The variability in febrile changes in different cases with the same disease, the sudden fall in rigors, the sudden fall in crises, the ease with which convalescents from long-continued fever show slight or even high fever following the ingestion of too much food, the fact that children whose heat-regulating apparatus is not fully developed easily develop high fever without rhyme or reason, all speak for some disturbance in the heat-controlling apparatus. I firmly believe future investigation will find that heat control is perhaps as important as heat production.

So far in this discussion we have treated fever from the standpoint of the infections only. Let us take up other forms. Chemical fever is known. The fevers that follow the long

continued injection of sodium chlorid, the fever that follows kidney injections for a pyelogram or injections for pyelitis are examples of this sort of fever. It is possible that some of the unexplainable fevers often found in treatment may be due to overdosing. The injection of foreign protein has already been mentioned. The fever in carcinoma, in the acute leukemias, may be due to a protein absorption. The so-called aseptic fevers which follow hemorrhages, where the hemorrhagic content is retained, and the fever often found in the anaphylactic diseases, such as asthma, hay-fever, urticaria, etc., may be thus explained.

The relation of the nervous system to fever is obscure. Very little is known about this relation. There are certain nerves which govern the muscles, glands, skin, etc., which are probably in some manner under the control of a heat center supposedly located in the corpus striatum. Puncture of this region produces an increased heat production by increased combustion of the carbohydrates. Destruction of the ventral portion of the optic thalamus destroys the heat control in rabbits. The cutting of the cervical cord has the same effect. The pressure of hemorrhages, of tumors, etc., at the base of the brain may produce fever by interfering with the centers in that region.

The so-called hysteric fever is an open question. It is probably true that the authenticated cases of high fever in hysteria may be due to some obscure or overlooked physical ailment which may at the same time be the cause of the fever and also the hysteria or nervous manifestation. The presence of slight fever in the so-called neurotic is often found. I will refer to this later in the discussion.

Woodyatt, of Chicago, has produced high fever in dogs by injecting hypertonic solutions of glucose, the glucose producing a dehydration by changing the colloidal condition of body proteins so that water is bound to the colloids with the resultant lack of mobility of the water molecule. This result is an apparent dehydration accompanied by fever. This observation is a new and important one. The fevers following rapid loss of water, such as diarrheas in children, etc., may be thus explained.

The daily variability and fluctuating character of fever in

many diseases has never been satisfactorily explained. The fact that seemingly insignificant causes often are accompanied by high fever and vice versa is also unexplained. The comparatively low fever in diphtheria with a high toxicity of the invasion is one example of the latter.

In the study or diagnosis of a high fever we can soon arrive at the cause. Of course, some cases are more obscure than others. Slight fevers often present the most difficult problems we encounter.

What is meant by slight fever? The usual classification of fever is as follows:

1. Subnormal—below 96.8° F.
2. Subfebrile—99.5° to 100.4° F.
3. Slight—100.4° to 101.2° F.
4. Moderate—101.2° to 103.2° F.
5. High—103.2° to 105° F.
6. Very high—105° F.
7. Hyperpyrexia—107° F.

In this discussion I wish to make the slight fever limits 99.4° to 101° F. Those fevers around 99.6° to 100.6° F. are the ones that are most often troublesome or overlooked. Anyone, if he takes the trouble to record the temperature of his ambulatory or office patients, will be surprised to find how often he will discover temperatures of 99.4° to 100.5° F. particularly in young adults and those slightly older, say up to thirty-five years of age. To determine the cause of this is often a most difficult task.

The first class of cases to which I wish to call your attention is that class with some focal infection. The subject of focal infection has, like many other things, been overdone; but it has so often shown itself to be an entity that we cannot ignore it.

In spite of constant warnings to watch for them, it is surprising to know how often tonsillar infections are found. I have repeatedly seen patients with marked nervous symptoms, with a slight fever, often a palpable thyroid, particularly in young women, where tonsillectomy resulted in a changed patient. It is often the small, innocent-looking tonsils that are ignored, which, upon a careful examination, are found infected.

Infected teeth is a condition that has also been overdone, but all the ills of life do not come from infected teeth. There are, however, many clear-cut cases, but they are not usually found in the young. They are discovered more often in middle life. We do not so often find slight fever in these cases, but it is found.

Chronically infected gall-bladders are difficult to diagnose. Here, again, we find them most often in adult life. These patients often have slight fever coming on for no accountable reason. It may disappear and again return. Overexercise, overeating, and excitement seem prone to excite the attack.

Infected nasal sinuses, infected uteri and tubes, infected prostates, infections of the rectum and sigmoid, pyelitis, cystitis in aged women due to colon bacillus are often accompanied by irregular, slight fever. A constant remembrance of these possibilities often leads us to the diagnosis.

Endocardial infection is a common cause of these fevers in the young.

Early tuberculosis is frequently overlooked because of failure to make a systematic study of the temperature. These patients often run a slight fever even before any other symptom shows up or even before there is a discoverable lesion. Excitement or muscular activity often cause a definite rise of a hitherto low-grade fever.

The most difficult cases and the ones most frequently passed up are the so-called neurasthenics.

Thyroid intoxication in young women, *often* in young men, is frequently accompanied by a train of symptoms, such as lack of muscular vigor, neurasthenic symptoms, gastric disturbances, and difficulty in standing the pressure of life. They complain of various and sundry aches, and often we find slight elevations of temperature. The thyroid is enlarged, the pulse is rapid, and tremors of the hands can be elicited. Young women in the late 'teens and early twenties can be found by scores who fall in this class. Very frequently infected tonsils or other focal infections are accompaniments. A study of their basal metabolism will help in making a differentiation from a neurosis or

other cause. I do not know whether the low-grade fever is a result of an increased chemistry or of some disturbance in heat regulation. The part played by sympathetic stimulation in these cases is still undetermined.

Syphilitic infections are frequently accompanied by low-grade fever. Our text-books are usually silent on this point. Bone syphilis, visceral syphilis, syphilitic aortitis, and nervous syphilis are all apt to be accompanied by slight fever. Paretics are especially apt to develop temperature due to the infection or to some other cause.

Physical deficiency and neurasthenia are often accompanied by slight fever. Why is this? A discussion of neurasthenia is not within the purview of this paper; but often we come in contact with young patients who have all the ear-marks of the neurotic. They complain of a long train of symptoms the chief of which is nervousness, weakness, both mental and physical. Many of them show an elevation of temperature. After an examination some are clearly cases of early tuberculosis, some are toxic thyroids, some have focal infections, some are syphilitics, etc. The question naturally arises: Is there some cause in all, and may neurosis, therefore, be really a broad general symptom of a diseased body? In many of these cases prolonged search often fails to reveal anything on which we may hang a diagnosis. I am sure we all have met such cases and have been puzzled. I am firmly convinced that a physical inferiority is a factor which is frequently overlooked. This inferiority may be congenital, either due to parental disease, an unbalanced endocrine system, or familial physical qualities. These patients do not measure up physically to what they should. They have a poor muscular development, an unstable nervous and circulatory mechanism, etc. They belong to a certain physical type called the asthenic. Mentally they are above the average, but they fatigue easily. They do not stand the stress of life well, become self-centered, and, as they say, "just nervous." What can we say about their temperature responses? They feel better in winter, but cannot stand the cold of winter or the heat of summer. In other words, environment controls them.

During the hot summer months of 1917, while examining drafted men, I found many such individuals whose most pronounced symptom was a vasomotor irritability with a tachycardia. Later on in the army service this was called *neurocirculatory asthenia*, and still later *effort syndrome*. I made similar observations during the summer of 1918, with the added fact that many of these men were carrying temperatures varying from 99.4° to 100.5° F. Some of these turned out to be tuberculosis, some hyperthyroids, and some focal infections. The majority, however, showed no evident diseased condition. They were usually of the asthenic type, with tremors, rapid hearts, and usually a slight temperature. The number ranged from 10 to 15 per cent. of the whole number examined. The temperature of myself and associates as well as of those of the remainder of the men was normal. What does this slight fever mean? I am firmly convinced that along with their evident physical inferiority there is an unbalanced heat-regulating apparatus. I offer no explanation, but merely state that certain individuals, generally those below par physically, who are not evidently diseased, have a slight elevation of temperature in hot weather. I am also convinced that people who are suffering with toxic thyroids, early tuberculosis of the nervous type, convalescents from long-continued fevers will often respond in a similar way, namely, by a slight rise of temperature when the surrounding atmosphere is high.

It will be interesting to investigate this condition from the standpoint of the basal metabolic rate and chemical change in the body. If the metabolic rate is found to be high, we would expect these slight fevers in this class of people naturally to be due to the increased chemistry. If not, the fever would be due to an unbalanced heat control. Considerable work has recently been done in various centers in this field in order to differentiate the psychopathic individual from the toxic thyroid cases. The results are, as a rule, in conformity with the clinical evidence and diagnosis of the worker. Many of this class which we have called the physically inferior are psychopathic or potentially so. The slight fever which I have stated is so common, from the best

evidence obtainable is not a so-called metabolic fever. We must, therefore, consider it as caused by some derangement in the heat control. It may be possible that these individuals have not developed along normal lines, and that their heat centers and nerve relations partake more of the infantile than the adult type.

From the discussion so far we have found that many people with focal infections, with slight tuberculous infections, with thyroid intoxication, with psychopathic symptoms, usually found in people with certain inferiorities, often are found with slight fever. It is evident that the cause of the fever in the focal infections and tuberculosis will be the same as that in more severe and acute infections with a higher ranging fever. Whether this be an increased chemistry or disturbances in heat control, or both, we cannot say. However, it is possible that the chemistry of the infection may have produced some nervous instability, as is so often shown in these cases. The result of this may make the heat control the factor of most importance. The cause of the fever in toxic thyroid cases theoretically ought to be due to the increased chemistry, but the fact that in most severe thyroid intoxications with a marked increase in the basal metabolism high fever is uncommon, speaks against this theory. Also the fact that all cases of true thyroid intoxication are notably nervously unstable speaks in favor of some derangements in the heat control. Again, the fact that focal infections are rather frequent in these cases of mild thyroid poisoning speaks for a combination of the chemical and the heat-regulating causes. The cause in those individuals with the unstable nervous symptoms of various kinds is probably a developmental deficiency of either the circulatory or nervous system. These individuals respond to their environment abnormally, and one of these responses is the manifestation of a slight fever in hot weather.

The object of this discussion is to stimulate all who have to deal with the diseases of mankind to a closer observation of their patients, particularly those who show slight elevations of temperature. It is believed that a greater number of correct diagnoses will then be made in those cases which are not evidently sick.

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SOME NEUROPSYCHIC REACTIONS ASSOCIATED WITH DISTURBANCES OF OVARIAN FUNCTION

THE importance of disease of various organs other than the nervous system in the production of neuropsychic disorders has been rather generally recognized for a considerable period in the past. The work of Bonhoeffer some years ago added an especial interest to the study of these reactive states, and what have become known as the symptomatic psychoses have since then received a greater attention as a result. This group at first included practically only those acute psychoses of a delirious type, such as are seen with certain exanthemata, acute infectious fevers, nephritis or more chronic visceral disease, and the like. It is not surprising that with the surge of interest awakened by the comparatively recent increase in our knowledge of the endocrine system that we should have looked to disease or disordered function of this system as a potentially important causal factor in the production of neuropsychic pathology. And, of course, it is to be recalled that it is not a new idea that disturbance of function of one or more of the endocrine chain may give rise to such abnormal states. We have long been familiar with such abnormalities occurring in connection with thyroid disorders, and not so many years ago some ovarian dysfunction was in one way or another considered responsible for nearly all neuropsychic disorders occurring in the female. In the past, however, many of these etiologic suspicions, though frequently borne out by clinical experience, were based on entirely inadequate knowledge; there was too little of fact and too much of general speculation.

On this occasion it will be the intention to present for your consideration certain selected types of neuropsychic reactions met with in association with ovarian insufficiency. The time will be too short to consider this subject in its entirety. We will therefore limit our interest to some special types of reactions belonging in this large group, and will consider a few cases presenting neuropsychic disorders associated with disturbance of ovarian function incident to the natural or artificial menopause and climacterium. One is well aware that this is a very old and time-worn subject which is every now and then brought to life again by some new facts discovered or new theories advanced. The present vitality is occasioned by certain additions to our knowledge of endocrinology within the past several years. This additional knowledge has opened up new phases of the subject which have given rise to new points of view, and thus its clinical importance, especially from the therapeutic angle, has been greatly emphasized.

Before illustrative cases are presented it may be well to take up a few general points in order to avoid useless repetition. In the first place, it must not be understood that ovarian insufficiency results alone in disturbances of the nervous system that may be called psychoses. Disorders of lesser degree, but not on that account of lesser clinical importance to the physician, are, indeed, much more commonly encountered. It must be remembered that the nervous system is not constituted solely of the cerebrum, but, in addition, there are the spinal and vegetative nervous systems to be considered. The last is of particular importance from the viewpoint of neuropsychic reactions to disturbance of endocrine activity. Within recent years endocrinopathy has become one of the newly prominent etiologic factors in medicine. Psychiatry has not been slow to apply this new aid in the attempt to solve some of the problems shrouding the causation of certain abnormal neuropsychic conditions. Too much zeal in this direction is easily possible, and one must take care not to attempt to cover ignorance too readily by postulating an unproved and undemonstrable endocrinopathy as causation every time he is confronted with an obscure symptom complex.

Another phase of the situation must be mentioned because of its very fundamental and general importance. One endocrine gland must not be looked upon as an isolated functional unit, but rather as a member of a series of organs interacting upon each other. As a rule, disturbance of function or loss of function of one gland does not long exist before that of others becomes involved secondarily. In other words, we must in many cases substitute for the uniglandular disorder a pluriglandular aspect. To be sure, in most such instances the dyscrasia of one gland is dominant, while that of the others is secondary in character, although it is frequently found difficult to determine in which gland the primary trouble lies. Especially good examples of secondary pluriglandular involvement are to be seen in the combinations of disorder of the ovary and thyroid.

In this presentation we are assuming that certain neuropsychic abnormalities stand in the relation of reactions to ovarian insufficiency. It is necessary, therefore, that we have some working proposition on which to base such an assumption. It is proposed that inasmuch as an established secretory disorder on the part of each individual gland leads to certain clinically recognizable chemicophysical alterations in the body, it is fair to assume that each of the resultant clinical types may be expected to exhibit more or less characteristic deviations from the normal, and that these will become apparent in the more or less directly correlated abnormal nervous system reactions.

It was mentioned that this is an old subject. Psychiatrists and gynecologists have been more or less generally in disagreement on this matter for many years past. The reason, however, seems not far away. In that period when the female generative organs were dragged in etiologically to explain some mental disorder it was largely on the basis that there was some gynecologic abnormality which could be corrected by surgical procedure or local treatments. Less attention was paid to the chemicophysical activities of the ovaries such as we are beginning to study more intensely nowadays. Not knowing much about the function of the internal secretions of these glands and knowing

little more than that they were the organs of ovulation, it was not surprising that at one time a complete oöphorectomy was advised to cure the mental disorder, and at another time, with the same clinical picture, operative interference was considered contraindicated.

In the female, menstruation has made the development and cessation of ovarian activity easy to determine. For this obvious reason, if for no other, much study has been given to the correlation of abnormal neuropsychic states and ovarian disturbance. As a result of this psychoses occurring during the puberal and climacteric epoch, and in association with the menstrual period or gravidity, have been described. Indeed, by some, such psychoses in their symptomatology have been considered characteristic of the epoch with which they were associated. Thus we have heard of adolescent, menstrual, puerperal, or climacteric psychoses, as the case might be. It is aside from our present purposes to discuss these psychoses as a group. They are to be looked upon as mental reaction types, and not as psychoses in any way characteristic of the epoch with which they are temporally or causally associated.

Psychoses, naturally enough, are particularly apt to occur during these periods of physiologic stress during which there are profound alterations in the fundamental activity of the endocrine glands with a necessary readjustment in the chemical balance of the body which must in more or less nervously unstable individuals have a deep influence on their neuropsychic organization. Thus we may see endogenous psychoses, such as dementia præcox and manic-depressive, develop at this epoch. Such, however, are not characteristic of the epoch, but are but the expression of the individual's constitutional psychic make-up brought to the surface by the endocrinous disturbance. Considerable doubt has been expressed as to whether ovarian insufficiency can directly cause any true psychosis, but rather is it believed that this endocrine element acts as an accessory moment only. This is probably true and gives all the more reason for considering such neuropsychic abnormalities as may appear in the light of individual reactions, and, therefore, their

character will in large part depend upon the underlying personality.

The reactions on the part of the nervous system and psyche to ovarian insufficiency are less likely to express themselves in phychoses than in alterations in personality or in neuroses of lesser or greater severity. The type of neuropsychic reaction will depend upon several factors, primarily the age of onset of the insufficiency, its acuity or chronicity, and its extent or degree of completeness. Leaving this general discussion, we will now proceed to the consideration of a few cases which illustrate some types of neuropsychic reactions met with in patients with ovarian insufficiency. Although these show some of the usual reactions, there are certain features that are of sufficient interest to merit some special discussion in connection with the presentation.

CASE I

Neuropsychic reaction, a confusional state. Origin endocrinopathic, ovarian insufficiency, late castrate; secondary thyroid involvement. Probable syphilitic factor.

The history of this patient shows nothing unusual in her early life. For several months just prior to the beginning of this illness she had worked excessively with the Red Cross. There is no history of alcohol or drug addiction. About five years ago had an uneventful typhoid fever. Menstruation was established when about fourteen years of age, of the twenty-eight-day type, regular in time, with no pain, and, so far as can be ascertained, normal in all respects until the onset of gynecologic symptoms, which led to a panhysterectomy for fibroid tumor about three years ago. She has been married fourteen years and pregnant three times, resulting in a miscarriage at six months and two children which died within a few hours after delivery. Syphilis is probable, although there is no definite history of infection and blood Wassermann has been negative. The husband gives a definite history of syphilitic infection and shows clear signs of cerebrospinal syphilis at the present time. There have been no previous attacks of mental or nervous disorder and no distinct psychopathic traits, although she has

been, as other members of the family, considered of "nervous make-up."

The present illness began in the spring of 1919 at the age of thirty-seven. The onset was gradual, with much insomnia and feeling of exhaustion prominent. At the time of onset patient complained of being very obese, "uncomfortably fat." Blood-pressure at this time was somewhat over 200 and she was considered seriously ill and received hospital treatment for a few weeks. Mental symptoms first occurred in July, and consisted largely of marked confusion, inertia, and depression. This mental state became gradually more and more intense until she attempted suicide on August 8, 1919, and was admitted to the hospital. On admission she weighed 105½ pounds. Examination showed considerable growth of hair over the face and extremities. There was an acneform eruption over the back, chest, shoulders, and upper arms. Considerable flabby subcutaneous puffing of the neck on the lateral aspects below the jaw and a very noticeable supraclavicular and nuchal padding. The skin was rough, dry, harsh, and thickened, especially over the arms and legs. Thyroid gland was not palpable. Chest negative. Heart action slow, with an occasional extrasystole, not enlarged, and otherwise negative. Abdomen negative, inguinal glands palpable. Urine contained no sugar, no casts, but a trace of albumin. Pupils were equal, regular, reacted normally to light, directly and consensually, and to accommodation. Tendon reflexes were hyperactive, but equal on the two sides. No pathologic toe signs. No facial or eye muscle weakness. Neurologically otherwise negative. The psychic state was one of mild confusion and depression. She was only partially oriented; especially was there disturbance in the temporal and personal fields. She appeared exhausted and complained of fatigue. There was inertia, association processes were retarded with a slowness and apparent difficulty in comprehending and answering questions. Depression and despondency were evident, she feared she would not get well and felt it was useless to make the effort to try. An examination of the blood and spinal fluid could not be obtained.

Treatment was instituted for the ovarian insufficiency, with subcutaneous injections of corpora lutea, one ampule, three times weekly. On the history she was also given antisyphilitic treatment, intramuscular mercury.

For the first few weeks after coming under observation there was not much change in her condition, she continued obviously much depressed. There were many somatopsychic complaints not substantiated by examination, such as that she was blind, deaf, etc. She thought she had been poisoned (referring to treatment given her early in the course of her illness).

On August 20th she was started on thyroid gland, grain ½ by mouth, three times daily. A week later she had become quite restless and irritable and decidedly more confused. From then on she became more inaccessible, much retarded, irresolute, complaining of exhaustion and physical weakness, especially in her legs. Auditory hallucinations developed, but could not be analyzed adequately owing to lack of co-operation. These were associated with imperfectly expressed delusions of persecutory trend.

On September 9th she complained of weak, fainting sensations. Examination showed a very rapid heart action, profuse perspiration without exertion, temperature 100.4° F., blood-pressure 200–135. Heart, lungs, and abdomen were negative, extremities cold. There was no pain. Thyroid gland and mercury were discontinued and patient was put to bed for complete rest. Pulse and temperature until this time had been slightly subnormal in the morning, with a slight evening rise. The persistently high blood-pressure, rapid, irregular pulse, and the finding of casts and albumin in the urine led to a consideration of a cardiovascular-renal complication, but renal function tests showed only a slightly reduced activity (40 per cent.), and no other evidence of organic disease could be found.

From the time when patient was put to bed with complete rest her condition improved gradually, although for several weeks weakness was still evident, heart action continued rapid and irregular. The confusional state lessened somewhat, though delusions and hallucinations continued in mild form. All medica-

tion was discontinued but corpora lutea, an ampule daily until her discharge from the hospital convalescent December 22, 1919. On discharge there were no psychic abnormalities, pulse and temperature were normal, urine contained no casts or albumin, and blood-pressure was normal. The only remnant discernible of her previous illness was a rather general feeling of weakness, but not pronounced.

To avoid the daily clinical charts in detail a summary of the pulse, temperature, respiration, and blood-pressure is shown in graphic form in this table, the high and low readings for each of the periods designated being shown:

Period.	Pulse.	Temperature, ° F.	Respiration.	Blood-pressure.	
Sept. 10–18.....	150–100	100.3–97	36–18	210–135	180–125
" 19–30.....	138– 98	99.2–97	24–18	190–140	170–135
Oct. 1–12.....	128– 62	99.2–97.2	28–16	190–130	140–110
" 13–25.....	128– 78	99.2–97.8	24–18	190–125	150–120
" 25 to Nov. 7.	102– 78	98.8–97.8	30–18	180–130	150–120
Nov. 8–20.....	118– 78	99.2–97.8	24–18	190–125	160–120
" 21 to Dec. 2.	118– 82	98.6–97	24–18	170–120	140–118
Dec. 3–15.....	118– 82	98.6–97	20–18	180–125	145–115
" 16–22.....	118– 78	98.6–97.8	24–18	165–120	140–110

Following discharge from the hospital this patient has continued well and has assumed her normal activities. There has been a gradual increase in weight to 130 pounds.

Discussion.—This case presents many points of interest, but especially the reaction to the thyroid gland medication. It is unfortunate that a basal metabolism determination was not feasible, as it would have given information of considerable value and interest. Under the circumstances it became necessary to use the clinical test to determine the possible disturbance in the thyroid activity. The physical signs indicated a hypothyroidism, and its frequent association with ovarian insufficiency lent plausibility to such a conclusion. It seems difficult to explain the marked change in temperature, pulse-rate, and general symptoms on any other basis than thyroid intoxication, and the more so as betterment occurred with discontinuance of the use of the gland.

Another interesting feature in this case is the possible cardio-

vascular renal involvement. The disturbance of heart action, the high blood-pressure, and the urine findings were very striking. And yet examination failed to reveal any organic lesion of the heart and the renal function tests gave results within normal limits. And here again it is significant that the condition cleared entirely under ovarian substitution treatment alone.

The long prodromal phase, marked by evident and gradually increasing physical disability preceding the neuropsychic reaction, would indicate the character of the underlying slowly progressing ovarian insufficiency. It is the rule that neuropsychic reactions of the severity shown in this patient do not occur for a considerable period of time following the abrupt discontinuance of ovarian function. And again this would indicate that it takes considerable time for the related glandular insufficiencies secondary to the removal of the ovarian function to develop.

The very probable syphilitic factor in this case is of importance in an etiologic way inasmuch as this is one infection underlying many disturbances of endocrine function.

From the therapeutic point of view this case demonstrates the very great value to be derived from the persistent use of endocrinic products in proper cases.

CASE II

Fundamentally a psychopathic personality with a mental reaction of the psychasthenic type. Origin in ovarian insufficiency, late castrate, with secondary hypothyroidism.

Present Illness.—*Complaints and Presenting Symptoms.*—(1) Nervousness; (2) occasional numbness and coldness in left side; (3) floating sensation in head; (4) insomnia; (5) emotional instability; (6) increasing irritability; (7) dyspnea on exertion; (8) pain in abdomen; (9) inability to finish things.

Development and Course.—Patient has been more or less nervous all her life. Following birth of her only child, now eleven years of age, her nervousness almost entirely disappeared, and she was in comfortable condition until about six years ago, when she had a "nervous breakdown" which kept her in bed about four weeks. Following this her nervousness was more or less accentu-

ated until three years ago, when she was operated upon, a complete panhysterectomy being done (March, 1917), since which time her nervous symptoms have increased very considerably up to the present time. There has been also since the operation a marked gain in weight. It is almost impossible to get a definite history from her at the present time as to the time of origin and order of development of her various symptoms. Various impulsions have been present; a desire to throw various articles, such as dishes and the like, ofttimes at her husband, but just as often at the side of the room or on the floor. With all this there has been a marked increase in irritability and very definite emotional instability leading to frequent crying and spells of anger. She admits a definite degree of sexual frigidity.

Associated Signs and Symptoms.—Occasionally has dizzy spells. Some dyspnea on exertion. Occasionally some palpitation. Some swelling of ankles, face, and hands. Appetite good. Some frequency of urination.

Personal History.—Age forty-three. Infancy and childhood negative, development not unusual. In disposition has always been cheerful and socially inclined. No alcohol or drugs. Up until seven years ago had "malaria" frequently, and six years ago some bladder trouble the nature of which is not now ascertainable. Has been married for nineteen years, with one child, now eleven years old and normal. Menstruation established at the usual age and normal until development of gynecologic symptoms, which led to a panhysterectomy for fibroid tumor.

Family History.—Both father and mother were "nervous"; one sister and three brothers all were "nervous," but none ever in hospital for nervous or mental diseases.

Examination.—General examination shows a well-developed and overnourished individual, obese, weight 217 pounds. No deformities, spinal column negative. Upper measurement 81 cm., lower measurement 86 cm., upper girdle span 169 cm., carpal circumference 17 cm., second metacarpal phalangeal length 15.5 cm. Mucous membranes pink. Bones and joints negative. Peripheral arteries not palpably sclerosed. Posterior cervical lymph-glands palpable, otherwise lymph-glandular

system negative. Generalized obesity with padding over backs of hands and fingers, and puffing of arms and lower legs. Some tendency to trochanteric padding. Considerable subdermal infiltration, generalized. Slight cloasmic pigmentation about angles of eyes and jaw and temples. Freckles about exposed surfaces. No unusual distribution of hair. Blood-pressure 140–85. Pulse of moderate volume and tension, regular and equal. Temperature 99.4° F. Urine is negative. Basal metabolism minus 7 per cent.

Head is of normal size and conformation. Hair very fine and rather ill-nurtured, although quite oily. Slight brownish pigmentation about eyes and side of face just below the ears. No thyroid eye signs. Some pyorrheal infection of gum margins. Slight posterior cervical padding. No supraclavicular padding. Heart and lungs negative. There is a midline abdominal scar. Slight tenderness in both inguinal regions. Abdominal viscera negative. External genitals normal. Perineum only moderately relaxed, cervix about a fingerbreadth from vulva. No uterus palpable. Stump of cervix distinctly palpable, not fixed, no tumefactions palpable in adnexa region.

Pupils equal, very slight irregularity in outline, react to light directly and consensually and to accommodation normally; sympathetic active. Some impairment of hearing on the right side. Slight lisping speech defect (congenital). Subjectively there is sensation of tingling and numbness in hands, which is variable and not constant. Also at times a feeling as though the entire left side were "numb and nervous." Motor system and reflexes normal.

Nothing unusual in general appearance as to dress and behavior. No grimaces or affectations. Patient is accessible, cooperates well with examination, and easily adapts herself to the situation. Answers introductory questions readily, but shows considerable tendency to prolixity and detail. Attention is easily gained, of diminished intensity, not well held to line of thought. Is otherwise stabile and dirigible. Oriented temporally, spacially, and personally. Memory shows no impairment. Recording faculty and power of recollection good for remote and recent

events. No amnesias, local or general. No retrospective falsification or fabrication. Consciousness clear and no clouding. Associational processes are rapid. There is some degree of circumstantiality and prolixity, with marked tendency to detail her complaints, but not in orderly sequence, so that her description leaves one in a haze as to just when and how a given symptom began, progressed, or ended. No delusions are present. No phobias or obsessions definite, though there is at times an insufficiency fear element, and impulsions are frequent, but at times controlled. No hallucinations other than of haptic character and body sense disturbances of cenesthesic type; feeling of numbness in hands, of left side of body, of coldness in vagina and lower abdomen. Emotional state is variable, unstable, but superficially nothing grossly abnormal noticeable. There is no evident depression or elation, she is not indifferent or irritable, shows no apprehension or anxiety. Associated with certain complexes, in speaking of her illness, her fear that she cannot properly raise her child, etc., she becomes emotional and shows slight lacrimosity. She states that she cries easily or becomes intensely angered without adequate cause. Has always had a bad temper, but usually got over it quickly, whereas now anger on such occasions lasts for days. Critique and judgment are not demonstrably impaired. Reasoning powers good. No intellectual deterioration. Insight into her condition is fair, but partial. She shows some fear she will lose her mind, but this is not at all insistent or fixed. There is evident a group of complexes centering mostly in the home life and involving husband and child. These, in all probability, have large bearing on some of the psychic anomalies, especially in the trend which they follow.

Discussion.—The positive points in the history of this case are a fundamental psychopathic make-up, on the basis of which there have been exacerbations of symptoms amounting to definite attacks on one or two occasions, with a general increase of all neurotic elements subsequent to castration in March, 1917. On the physical side there are syndromes indicative of ovarian and secondary thyroid insufficiency. Neurologic examination is

negative. Psychical examination shows impaired attention, emotional instability, impulsions. These factors go to make up a diagnosis of psychoneurosis, psychasthenic type, impulsion neurosis. In this patient we are dealing with a fundamentally psychopathic personality, an underlying abnormal mental make-up which has shown exacerbations in episodes, and the one which brought the patient under present observation incident to an artificial menopause. Here we have demonstrated in evident and clear lines the directly occasioned secondary hypothyroidism. This patient illustrates very well the desirability of looking upon these mental states as reactions and not as diseases in themselves. She illustrates this group well and there is little of the unusual or exceptional to be found in the case. The treatment, of course, is very clearly indicated—ovarian and thyroid substitution. It is well to remember here too that the results of such substitution treatment are going to be much enhanced by a liberal usage of psychotherapy after an adequate psychanalysis. It would be an unfortunate turn if the psychic element in cases such as this should be entirely neglected and the patient made to depend entirely on endocrinic substitution. What the outcome of this case has been has not been learned, as she remained under observation for too brief a period to determine.

CASE III

Mental reaction of psychogenic depressive type. Origin in ovarian insufficiency, climacteric.

Present Illness.—*Complaints and Presenting Symptoms.*—(1) Nervousness; (2) loss of mind control; (3) pain in right side; (4) easy fatigue; (5) no energy or ambition to do ordinary housework; (6) loss of interest in herself and family; (7) irritability; (8) melancholia and suicidal intentions.

Development and Course.—All of the present symptoms began about two years ago with no definitely known cause of onset, and have progressively grown worse. At first there was difficulty in planning the ordinary day's work of the household. Then came a period of pain and distress about the heart. She was told she had a high blood-pressure. Depression and inhibition

with introspection have been marked since then. Has lost 25 pounds in the past two years. Has frequently talked of suicide and at least once tried hanging. Says it felt uncomfortable and she stopped. Smiles when recounting this incident. A clear conception of the order of progression of symptoms cannot be worked out. Depression is the principal syndrome.

Associated Signs and Symptoms.—Headache is only occasional, not characteristic or prominent. Occasional nausea and vomiting in morning, but not for some time past.

Personal History.—Forty-seven years of age. Infancy and childhood negative. In disposition prior to present illness was always good natured, happy, jolly, and friendly; of uniform emotional tone. Has not used alcohol or drugs. Patient has always been in good general health. Has been married twenty years; no troubles or incompatibilities known. In past four years sexual desire absent, no intercourse. Two children normal, no other pregnancies. Menstruation began at about fourteen and was, till present illness, always regular every four weeks. Lasted usually about two days, with much pain and oftentimes headache. Has not been regular since two years ago, when absent for seven weeks, and now comes every two or three weeks, sometimes very profuse, again scant. Not associated with pain, always more nervous, exhausted, and sleepy during menstruation.

Family History.—Father died aged fifty of "creeping paralysis" following apoplexy. Mother alive, aged seventy-one, "a nervous wreck." One sister deaf. All mother's side of family nervous, but no instance of psychosis.

Examination.—Average general development: Weight 115¼ pounds. Upper measurement 80 cm., lower 79 cm., upper girdle span 155 cm., carpal circumference 41 cm., second metacarpal phalangeal length 16 cm. No lymph-gland enlargements. Bones and joints negative. No varicose veins. No edema. Blood-pressure 108–68. Pulse-rate 84. Peripheral arteries not palpable. Respiration not increased in frequency. Temperature 98.8° F. Skin of normal color, no unusual pigmentations, somewhat thickened and to a degree dry. Hair of normal development and distribution, rather generally gray. Some in-

creased subcutaneous fat padding at back of neck. Blood and urine examinations negative. Head is of normal conformation. Omega contraction very marked at times. No thyroid eye signs. Some thyroid fulness, gland palpable, no pulsations or bruit. Heart and lungs negative. Abdomen of normal appearance and contour, shows evidence of some adhesions about ascending colon and some constriction. Slight tenderness in lower right quadrant. Abdominal viscera negative. Uterus pulled slightly to right, probably from old inflammation, otherwise negative. Pupils equal, regular, and round in outline, react to light directly and consensually, and to accommodation normally, sympathetic reflex present. There is to be noticed a slight facial asymmetry with a tendency to draw the mouth to left with closure of the left eye when laughing. Hearing is impaired, only loud tones of spoken voice perceived. Cutaneous sensation, motor system, and reflexes are normal.

Patient presents nothing unusual in appearance other than that she is rather careless in the matter of dress; shows no mannerisms or affectations. Is accessible, though very verbose concerning ailments. Co-operates and adapts well, with no peculiar attitude toward examinations. She answers questions freely and shows no reticence concerning self or illness. Attention is difficult to gain at times (impaired audition?), fairly well held, but with marked tendency to revert to her own ills. Orientation is unimpaired for time, place, and person. Memory for remote and recent events is good. Recording faculty good. No amnesias, fabrications, or retrospective falsifications. Association processes in rapidity, facility, sequence, and uniformity of stream of thought unimpaired except for intrusion of ideas of self, illness, loss of mind, etc., at frequent intervals. No delusions or hallucinations elicited. Intelligence shows no deterioration; reasoning in general not impaired further than in reference to her illness. Emotional state is subjectively one of depression. At times there is evident distress, with the facial expression one of great worry, even fear. Occasionally laughs appropriately, even at herself at times when giving expression to her depressive ideas. There is a mixture of depression and feeling of indifference with no real ap-

prehension or anxiety. She has some insight into her condition, though very inadequate. Is quite sure she will not recover.

Subsequent Course.—Treatment for ovarian insufficiency consisting of corpora lutea, an ampule daily, with ovarian substance by mouth. Betterment in her mental state occurred within a few weeks, but became most noticeable after about four months, when she states she felt very well. Treatment with lessened frequency, and for the past four months she has shown no abnormalities, either mental or physical. Menstruation occurs at two or three month intervals, short in duration and scant in amount, but without any subjective or objective disturbance.

Discussion.—In this case we have been able to find no indication of organic involvement in either the central or peripheral nervous systems. We have a history of mental disorder occurring in association with disturbances of menstrual function at the devolutional epoch. These mental symptoms are of psychotic stamp, but not of distinctive variety, and without great autopsychic disintegration, but notable because of the many neurotic elements. Considering the whole case and its course with a final outcome in a complete recovery we are led to the conclusion that we have dealt with a depression of psychogenic character incident to and occasioned by alterations originating from the climacterium. There is, of course, room for the question as to whether or not this mental disturbance may have been allied to the manic-depressive group. And yet on closer scrutiny many of the essential features of that psychosis are lacking. There is, for instance, no indication in the history of any previous mental disorder or inclination to such. And also this condition had been existant for some two years before treatment along endocrine lines had been instituted, a rather long time for a manic-depressive psychosis. And then again there were lacking the true elements of an affect depression. It is really more questionable if we have not been dealing with a very severe neurosis.

Another feature of this case is the possible secondary hypothyroidism which, however, has not been emphasized in the absence of more definite substantiation of such a diagnosis.

The question also arises as to whether the treatment given in this case was the cause of the recovery, or was it merely incident to the natural termination of a mental disorder which had about run its course? There is really room for doubt. And yet past experience has brought to our attention many similar cases which left without the assistance of glandular therapy have gone on in a chronic course even after the climacterium has been ended. Everything considered, it appears fair to conclude that this case supports our working proposition that an established secretory disorder leads to certain recognizable alterations in the body which are associated with more or less directly correlated abnormal reactions on the part of the nervous system. It can be truly said that there is no better proof of the correctness of our diagnoses than can be found in the effects of the treatment which we have instituted. And this is particularly true in the field of endocrinology as applied to neuropsychic problems. When we assume or think we have proved that a certain abnormal mental state has its primary origin in the disturbance of function of one or more of the endocrine chain, and especially when this disturbance of function is on the side of a lowered activity, it is fair to put such an assumption to the therapeutic test. And when this test fails we must in fairness conclude that our assumption was not correct.

In conclusion it may be said that although our experience in the treatment of certain selected types of neuropsychic disorders is not yet large, there is much in the result so far obtained to warrant continued investigation and study of these types as reactions to endocrine disorder.

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THE BASAL METABOLIC RATE IN ENDOCRINE DISTURBANCE

The Basal Metabolic Rate in (*a*) Thyroidism, (*b*) Pituitarism (Classification of Pituitary Signs), (*c*) Disturbed Function of the Gonads, (*d*) of the Adrenals, and (*e*) Pluriglandular Syndromes. Presentation of Typical Cases. A Comparison of the Basal Metabolic Rate with Sugar Tolerance. Tabulation of Additional Cases.

THE clinical value of determinations of the basal metabolic rate is rapidly being established, and today this procedure is becoming an essential part of diagnostic medicine. The development of this science is interesting. It was initiated by Lavoisier in 1780. Liebig, later a resident of Paris, became interested, and on his return to Germany stimulated such notable workers as Voit, Rubner, and Pettenkofer. These workers, in turn, were of profound influence upon American observers. The researches of Lusk, Benedict, Du Bois, Carpenter, Means, Peabody, Gephart, Tompkins, and others are well known to workers in this fascinating field. The early investigations were purely of scientific interest, but in the natural course of events were applied to studies of disease. Magnus-Levy was an early contributor in this field. He was followed by such American workers as Lusk. Du Bois, Benedict, and others. Notable work was accomplished in diabetes, nephritis, anemia, leukemia, typhoid, and other fevers, and in the effect upon metabolism of such drugs as caffein, sodium salicylate, strychnin, atropin, morphin, epinephrin, and camphor. Naturally, disturbances of internal secretion and their effects upon basal metabolism, of particular consideration in this paper, soon attracted attention. To quote Graham Lusk:

"The literature regarding the action of the internal secretions upon metabolism is very large. Much of it is crudely unscientific. Where several unknown factors are interacting, as happens in this field of study, it is pleasant to give the fancy full play, and this is also a perfectly harmless occupation, provided such mental activity does not develop into hallucination.

"Du Bois, in writing concerning exophthalmic goiter, makes the ironic proposal, 'For the purpose of simplicity in this paper, one may consider the symptoms of exophthalmic goiter to be caused by hypersecretion of the thyroid and *allow* the *reader* to *select* for himself those cases in which he believes other glands to be involved.'" The significance of these remarks is very obvious, and should bear weight with students in this field.

Because of the intricate reciprocal relationship of the various glands of internal secretion there has, of necessity, been much confusion and full play of diagnostic fancy in the selection of jointly diseased glands. "Pluriglandular syndrome" has become a byword, and some of the arrangements have been, to say the least, artistically bizarre. The terms "dysfunction," "dyscrasia," etc., have served as a mask and have helped to confuse. The prerequisite in a study of this sort, an adequate classification, should take into account every known physiologic, anatomic, pathologic, and clinical fact. Each gland has a definite system of characteristic hormonic effects, and with proper clinical investigation of many of the pluriglandular syndromes the glands affected may be determined, and frequently which gland is physiologically preponderating. *Theoretically*, there are probably always minor reciprocal effects in all endocrine disturbances, but practically we believe we see uniglandular syndromes; for example, frank thyroidism, hyper- or hypo, presenting characteristic and distinctive symptoms, mental neurologic, gastro-intestinal, etc.

The physiologic phase, particularly the determination of the basal metabolic rate as an index to the activity of the thyroid, has been placed upon a firm basis by Du Bois, Means, McCaskey, and Sandiford, and is accepted by most workers as an index to the activity of the gland and to the efficacy of treatment.

THE PITUITARY

The value of the basal metabolic rate in the determination of the activity of other glands, for example, the pituitary and gonads, is less clear, and to venture in a small way to throw more light upon this phase has been the purpose of our work.

From fundamental, experimental, and clinical knowledge of the hypophysis it is quite definite that this gland exerts a control upon metabolism, and it is logical to presume that in disturbances of hypophyseal function the basal metabolic rate should be modified, and, if this be true, should be an index to the physiologic activity of the gland. A wealth of pathologic, clinical, and experimental fact, that cannot be here narrated in detail, supports certain considerations concering the hypophysis, namely, that the anterior lobe regulates and controls (1) the skeletal, cuticular, and subcuticular growth, and (2) the function and development of the gonads, and the secondary sexual characters; and that the posterior lobe is concerned with (1) the regulation of carbohydrate metabolism, glycosuria, hyperglycemia, and obesity, (2) the contraction of the involuntary muscles, peristalsis, uterine contraction, etc., and (3) the renal secretion, polyuria, blood-pressure, and body temperature. Notwithstanding these facts, there has been considerable argument concerning the rôle of the hypophysis cerebri and its effects upon metabolism, particularly carbohydrate tolerance and the basal metabolic rate. Means found a decreased basal metabolic rate in hypopituitarism with obesity; and Magnus-Levy, an increased rate in acromegaly. Cushing found an increased carbohydrate tolerance in dystrophia adiposogenitalis (or Fröhlich's syndrome), and a decreased tolerance in acromegaly or postadolescent anterior lobe hyperpituitarism. Forschbach and Severin, of Minkowski's Clinic, disagree, maintaining that in the most varied affections of the hypophysis (acromegaly, dystrophia adiposogenitalis, hypophyseal tumor, etc.) there is always a hypoglycemia and an increased carbohydrate tolerance. Cushing maintains that when the *posterior* lobe is rendered inactive by disease or compression, metabolic procedures are checked and a high tolerance is acquired for carbohydrates,

which are promptly stored as *fat*. Robertson states that pathologic conditions partially or totally destroying the function of the *anterior* lobe produce the clinical picture of *adiposity*, underdevelopment of skin, bone, primary and secondary sexual characters, etc. Beck in a recent classification includes the development of obesity (dystrophia adiposogenitalis) under the heading, "Anterior Lobe Deficiency." Snell, Ford, and Rowntree state, "Hyperactivity of the anterior lobe occurring in youth results in gigantism, and in adults, in acromegaly; while hypoactivity results in infantilism, and when combined with deficiency of the *anterior lobe* hormone, in Fröhlich's syndrome (or dystrophia adiposogenitalis). The latter writers also report basal metabolic determinations upon 7 cases of hypopituitarism, 5 of diabetes insipidus, and 2 of Fröhlich's disease; 2 cases of diabetes insipidus showed a definite increase, and 1, a moderate decrease, the remainder exhibiting no definite departure from the normal.

Considering the existing confusion, we deemed it fundamentally essential to martial all our available facts regarding the function of the pituitary body. First, not considering the mooted queston of a separate activity for the pars intermedia, the function of the gland is dualistic. The component parts are embryologically, histologically, and physiologically distinct. These physiologic differences are manifest through the hormonic signs, both subjective and objective, such as amenorrhea, dysmenorrhea, epileptiform attacks, somnolence, obesity, headache; definite changes in the osseous, genital, and dermal systems, blood-pressure, temperature, involuntary muscle contractions, etc. The laboratory furnishes data concerning metabolic changes, carbohydrate tolerance, oxygen consumption, CO_2 elimination, and a variety of intracorporeal chemistry. With these facts in mind, we append the following differential tables of hormonic signs (pages 779 and 780) and a classification of diseases of the pituitary gland (page 781), devised by Dr. Wm. Engelbach and myself:

These tables have been the basis for the clinical diagnoses in the tables to follow, and in this light we have tried to learn something more of the diagnostic value of basal metabolic de-

HORMONIC SIGNS OF THE ANTERIOR LOBE OF THE HYPOPHYSIS

	HYPOPITUITARISM		HYPERPITUITARISM	
A. Osseous	Preadolescent A. **Undergrowth. All bones** Lorain-Levi type.	Postadolescent A. **Undergrowth. Short and fat bones** only. (Normal long bones)	Preadolescent A. **Overgrowth of all bones (Gigantism)**	Postadolescent A. **Overgrowth. Acral, and fat bones** only. (Long bones short) **Acromegaly**
1. Stature a. Measurements	1 Short a. Torso greater than lower span less than height	1 **Tall, or normal** a. Varied. Torso greater than lower, or less than lower (rumpfwuchs)	1 Abnormally tall a. **Normal giant: torso = lower, span = height** Eunuchoid giant: torso less than lower, span greater than height Acromegalic giant: torso greater than lower, span less than height	1 Short and stocky, or normal a. Acromegaly: torso greater than lower, span less than height
2. Head a. Sinuses b. Nose c. Superior Maxilla d. Chin e. Sella Turcica (X-ray) 3. Hands a. Phalanges (X-ray) 4. Pelvis (X-ray) a. Cone	2 Small a. Small b. Pointed, straight c. Normal d. Pointed, sharp e. Small, except neoplastic type enlarged 3 Type "en petit," one-third smaller than normal a. Narrow, tapering, tuberosities and tufting absent 4. Broad, feminine type a. Valgum	2 Small a. Small b. Pointed, straight c. Normal d. Pointed, sharp e. Small, except neoplastic type enlarged 3 Small a. Narrow, tapering, tuberosities and tufting absent 4. Broad, feminine type a. Valgum	2 Large a. Large b. Blunt (eunuchoid giant) c. Normal, except prognathism in acromegalic giant d. Pointed, except prognathism in acromegalic giant e. Normal, except neoplastic type enlarged 3 Type "en longe," one-third larger than normal. No disproportion a. Wide, dense, tuberosities large, terminal tufting, exostoses 4. Narrow, masculine type a. Varum	2 Large a. Large b. Blunt, rounded c. Prominent d. Rounded, blunt. Prognathism e. Normal, except neoplastic type enlarged 3 Type "en longe," spade hand, wrist wide, fingers broad and clubbed. Infiltration of soft tissues over bones. Hands and feet enlarged a. Wide, dense, tuberosities large, terminal tufting, exostoses 4. Narrow, masculine type a. Varum
B. Genital 1. Gonads (ovary or testicle) 2. Uterus 3. Menses 4. Sterility and impotence 5. Secondary Sex Characters	B. 1 Infantile 2 Infantile 3 Amenorrhea, metrorrhagia, and menorrhagia 4 Present 5. Absent	B. 1. Normal 2. Normal 3 Amenorrhea, hypomenorrhea, and metrorrhagia 4 Present 5. Present	D. 1. Large, well developed 2. Normal 3 Normal 4. Absent (present after many years with transition to hypoactivity) 5. Present (even after hypoactivity occurs)	B. 1. Large, well developed 2. Normal 3 Normal 4. Absent (present after many years with transition to hypoactivity) 5. Present (even after hypoactivity occurs)
C. Muscular 1. Muscle Tone D. Mental	C. Proportionate to development 1. Normal D. Usually deficient or retarded	C. Normal 1. Fatigability frequent D. Average	C. Normal, or overdeveloped 1. Less after few years overactivity D. Apathetic (after activity changes)	C. Overdeveloped 1. Retained after age of 40-45 D. Abnormally developed, temperamental, hysterical, unstable
E. Dermal a. Teeth b. Hair Distribution	a. Occasional separation and forward enlargement of upper incisors good b. Absent	a. Occasional separation and forward enlargement of upper incisors b. Normal	a. Enlarged and separated upper incisors. Lowers separated in acromegalic giant b. Increase on torso	a. Separation of upper incisors constantly; frequently of lower, with prognathism b. Marked increase on extremities and chest
F. Temperature	F. Subnormal	F. Subnormal	F. Normal	F. Normal
G. Pulse	G. Slow	G. Slow	G. Normal	G. Normal
H. Blood-pressure	H. Hypotension, or normal	H. Hypotension, or normal	H. Normal. Hypotension after change to hypoactivity	H. Normal, or above normal

terminations in these pathologic endocrine states. We may note in passing that probably insufficient attention has been given to transformed states; that is, that certain cases may

show physical evidence of hyperfunction and physiologic evidence of hypofunction. For instance, an acromegalic (or post-adolescent anterior lobe hypersecretion) may change into a hyposecretion, retaining the gross physical characteristics of acromegaly, but exhibiting the functional features of hypo-

HORMONIC SIGNS OF THE POSTERIOR LOBE OF THE HYPOPHYSIS

	HYPOPITUITARISM	HYPERPITUITARISM
I. **Metabolism**	I.	I.
a. Basal Metabolism	a. Decreased	a. Increased
b. Carbohydrate Tolerance	b. Increased	b. Decreased
c. Glycosuria and Hyperglycemia	c. Absent	c. Present
II. **Adiposity**	II. Marked girdle, mons and mammary	II. Absent, usually emaciation
III. **Polyuria**	III. Present (Pars Intermedia?)	III. Absent (or present with glycosuria)
IV. **Involuntary Muscle Contraction**	IV	IV
a. Intestinal	a. Absent; frequent intestinal atony	a. Present; frequent intestinal spasticity
b. Uterine	b. Absent	b. Present
V **Endocrine Secretion**	V.	V.
a. Thyroid	a. Hypoactivity (hibernation)	a. Hyperactivity
b. Adrenals	b. Insufficiency?	b. Hyperactivity?
c. Gonads	c. Hypoactivity (with Anterior Lobe disorder)	c. Hyperactivity (with Anterior Lobe disorder)
d. Pancreas	d. Normal (increased sugar tolerance).	d. Hypoactivity (decreased sugar tolerance)
VI. Nervous	VI. Apathy; Somnolence frequent	VI. Psychic instability
VII. Temperature	VII. Subnormal	VII. Normal
VIII. Pulse	VIII. Slow	VIII. Rapid

activity, such as myasthenia, decreased mentality, loss of libido, etc. In this type of case the determination of the basal metabolic rate, we believe, is particularly valuable, because it serves as an index to the physiologic state at the *time of observation* and to the proper procedure in a therapeutic way.

CLASSIFICATION—DISORDERS OF THE PITUITARY GLAND

I. **Anterior Lobe**	
A. **Hypo**activity	
1. **Pre**adolescent a. Aneoplastic b. Neoplastic	**Lorain-Levi Type**
2. **Post**adolescent a. Aneoplastic b. Neoplastic	**Amenorrhea, Dysmenorrhea, Metrorrhagia** reacting to Anterior Lobe treatment. No signs of Posterior Lobe disorder
B. **Hyper**activity	
1. **Pre**adolescent a. Aneoplastic b. Neoplastic	**Gigantism** (no signs of Posterior Lobe disorder)
2. **Post**adolescent a. Aneoplastic b. Neoplastic	**Acromegaly** (no signs of Posterior Lobe disorder)
II. **Posterior Lobe***	
A. **Hypo**activity	
1. Pars Intermedia (?)	**Polyuria** (Bab) (Reaction to Pituitrin. Signs of Anterior Lobe and Pars Nervosa disorder absent)
2. Pars Nervosa	Pituitary **Obesity** (Decreased metabolism, increased sugar tolerance. Polyuria and signs of Anterior Lobe disorder absent)
B. **Hyper**activity	Hypophyseal **Glycosuria** (Increased metabolism, decreased sugar tolerance. Polyuria and signs of Anterior Lobe disorder absent)
III. **Bilobar***	
A. Anterior and Posterior Lobes	
a. **Hypo**activity	**Froelich's Type** without, or with polyuria (Biedl)
b. **Hyper**activity	**Gigantism** or **Acromegaly** with **increased** metabolism and **decreased** sugar tolerance. Adiposity absent.
c. **Hetero**activity	
1. Anterior Lobe hyperactive Posterior Lobe hypoactive	**Gigantism** or **Acromegaly** with **Polyuria**
2. Anterior Lobe hypoactive Posterior Lobe hyperactive	Genital Aplasia, Nanism, Amenorrhea, etc., with Pituitary Glycosuria (Increased metabolism; decreased sugar tolerance)

*(1) Pre- and (2) Postadolescent varieties and (a) Aneoplastic and (b) Neoplastic types are subdivisions under each activity (Hypo and Hyper) as given under I Anterior Lobe.

THE GONADS

In connection with deficiency of the gonads we recognize certain gross metabolic effects, such as changes in skeletal growth, development of dermal appendages, and characteristic obesity. Whether these effects are primarily gonadal or the results of secondary reciprocal endocrine effects is very much of a question. Lüthje in 1902 found that castration in dogs of both sexes

had no influence upon the metabolism. Snell, Ford, and Rowntree recently have found that a rather consistent rise in the basal metabolic rate occurs during menstruation or in the premenstrual period, the rise being followed by a postmenstrual fall. Janney states that he has seen 2 cases of hypothyroidism, each having previously been subjected to a complete hysterectomy, in which it was impossible to bring the metabolic rate to normal without the development of symptoms of a somewhat distressing nature, as tachycardia, precordial distress, and increase in nervousness; and further states that it is a question as to whether the loss of ovarian secretion also causes a depression of the basal metabolism. In conformity with this view, the writer has seen a decreased metabolic rate in a number of cases that have been deemed pure gonadal insufficiencies and showing no *clinical* evidence of reciprocal thyroid or pituitary involvement. One such case will be reported in detail. It must be admitted, however, that most testicular and ovarian insufficiencies have been definitely associated in a clinical way with other glandular insufficiencies to such an extent that it is difficult and ill-timed to attribute a decreased metabolic rate to a primary gonadal deficiency.

THE ADRENALS

Tompkins has shown that the metabolic rate is markedly increased by the administration of epinephrin. We have had under observation cases of partial adrenal insufficiency associated with clinical signs of other endocrine deficiency, that have shown definitely decreased rates. Unfortunately, we are able to offer no data concerning the basal metabolic rate in frank cases of adrenal insufficiency, such as Addison's disease, and are familiar with no such reports in the literature.

PLURIGLANDULAR SYNDROMES

In our polyglandular insufficiencies we have attempted to specify the glands affected. This attempt, as exemplified in the tables under the consideration of the pituitary gland, has been based upon a consideration of the presenting hormonic signs.

A thyroid deficiency presents different clinical manifestations than a pituitary deficiency. For example, it is surely possible to distinguish the classical girdle mons, upper thigh obesity of a posterior lobe pituitary insufficiency from the typical obesity of a frank hypothyroidism. Again, the obesity of a late castrate has certain prominent differential features. To go further into detail, the mental, dermal, muscular, cardiovascular, and gastrointestinal features are clinically different. Of course, such combinations as thyroid and pituitary deficiency are exceedingly common, and in our classification this diagnosis has been based upon the associated hormonic signs, and from the prominence of certain hormonic signs we believe it has been possible to distinguish the particular gland in which the deficiency is most marked. The thyropituitary insufficiencies have shown the most striking decreases in basal metabolism, but we have some cases showing absolutely no hormonic evidence of thyroid deficiency which have been classed as pituitary-gonad insufficiencies, showing very definite decreases in the basal metabolic rate.

The instrument used in our observations has been the Benedict portable respiration apparatus. In our calculations we have employed the linear formula of Du Bois and Du Bois, and the graduated table of average calories per square meter of body surface per hour for age and sex of Aub and Du Bois.

Careful corrections for temperature and barometric changes have been made, despite the fact that certain workers have deemed this procedure unnecessary for clinical purposes. Upward variations to +10 per cent. and downward variations to —7 per cent. have been considered within the normal. Because of time limitation we will report but a few cases in detail, tabulating the remainder.

CASE I

W. H. P. F. Aged fifty-six. Gen. No. 1480. Referred by Dr. E. K. Allis, New Douglas, Ill.

History.—The patient has not been feeling well for twenty-five years, and has noticed a gradual increase in the following symptoms: *fatiguability; swelling* of the face, abdomen, and lower

extremities, with sense of *heaviness;* considerable dyspnea and nycturia; vague pains in the back of the head and neck and about the body; *vertigo*, tinnitus aurium, scotomata, and photo-

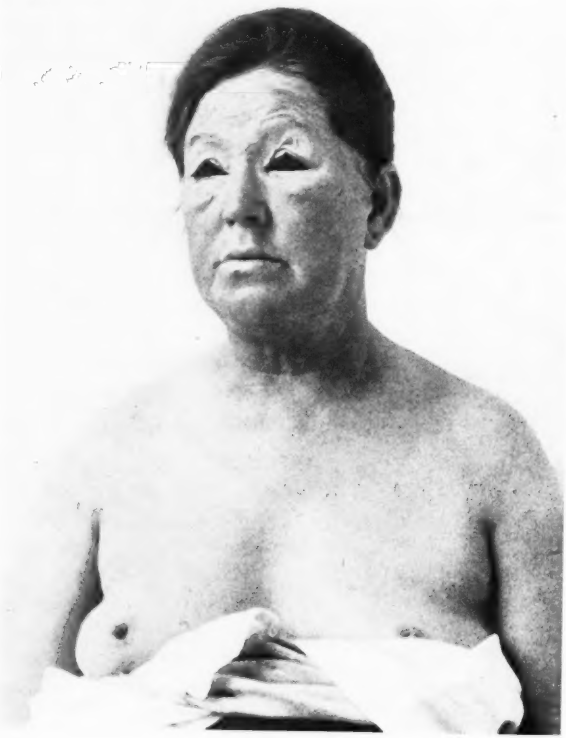

Fig. 72.—Case I. Note heavy, mask-like expression, narrow palpebral slits, high saddling of nose, fulness and tendency to cracking of lips, and padding about face and in supraclavicular fossæ.

phobia; huskiness of the voice (with statement that voice has become more *masculine*). Her *weight* ten years ago was 125 pounds and is now 187 pounds. Marked *constipation* is present, associated with abdominal disturbance. There are marked

mental changes, decreased cerebration, memory defect. and apprehension concerning mental stability. *Past:* Malaria, typhoid fever. *Personal:* Constipation. Insomnia, due to excitement and restlessness. *Family:* Father died at the age of sixty-seven of *diabetes*.

Examination.—*General:* Weight, 187 pounds. Height, 5 feet, 6 inches. Measurements: Symphysis to vertex, 83¾ cm.; symphysis to soles, same; span, 172½ cm. Temperature, 97° F. Pulse, 64. Patient constantly regurgitating gas. Striking *alabaster* color, slight cyanosis of lips. Expression *mask-like* and immobile, with marked edema of upper and lower eyelids. No saddling of nose. *Lips thick.* Slight *malar flush. Adiposity* general, tendency to girdle type; *supraclavicular padding* rather decided, no padding on dorsa of hands. Fingers, however, swollen and puffy. *Skin dry* and *harsh*, branny desquamation and *subdermal infiltration*. No edema, but definite *subcutaneous infiltration* of legs and ankles. Hair on head normal, absence of axillary hair, very slight amount on mons. Eyebrows thin. *Mentality* very much *decreased*. Speech *slow*, cautious. *Regional: Decreased* air conduction. Eyes deep-set, palpebral slits *narrow*. Pupils unequal, left larger than right. Lips thick. Thyroid not enlarged, very marked supraclavicular *padding*. Heart sounds slow and regular, but distant and dumpy. Blood-pressure, 130/100. Enlargement of hemorrhoidal veins. Subdermal *infiltration* of extremities, *without pitting*, but showing marks of lacings and shoe tops. *Urine* (catheterized): Trace of albumin, otherwise negative. *Functional kidney test* (phenol-sulphonephthalein): Total, 25 per cent. *Blood:* Hemoglobin, 94 per cent.; leukocytes, 5400; erythrocytes, 3,912,000; Wassermann negative. *Blood non-protein nitrogen*, 37 mgm. per 100 c.c. *Sugar tolerance:* Blood-sugar after fifteen hours' fast, 0.10 per cent. (normal, 0.10–0.13 per cent.); first hour (after 1.59 gm. dextrose per kilogram of body weight), 0.118 per cent. (normal, 0.18 per cent.); second hour, 0.10 per cent. (normal, 0.15 per cent.). *Basal metabolic rate*, —39 per cent.

Results of Treatment.—The above case, one of frank myxedema, shows the lowest basal metabolic reading in the series.

The case passed from under observation with recommendations for treatment. The results are unknown.

CASE II

O. W. B. F. Aged forty-six. Gen. No. 1401. Referred by Dr. George Crile, Cleveland, O.

History.—Pubertic goiter occurred at the age of fifteen, with absolutely no indication of toxic symptomatology. The patient was given local iodin treatment. Fifteen years ago the patient became conscious of cardiac disturbance, irregularity, and paroxysmal tachycardia, becoming more and more marked until 1915, when there was almost constant complaint. At that time the patient was seen by Dr. Crile, who performed a partial thyroidectomy. To abbreviate Dr. Crile's operative records: "The hardness was diffuse, suggesting malignancy. As we cut down, we found the muscles invaded. However, not a blood-vessel was to be seen. A section was removed from the hard, white, indurated tissue which extended over the entire gland on both sides, crossing the midline (white and smooth), which was reported non-cancerous. Underneath the white, hard, bloodless zone thyroid tissue was found, normal except for a decreased blood-supply. The thyroid lay within ½ inch thick capsule, as a shell lies within the casing. We dissected out this hard casing from the balance of this gland as far as we could, extending from the right border of the thyroid across the midline to the left border of the left lobe. This heavy white capsule extended down to and upon the trachea. At this point we left some of the capsule behind, resting on the trachea. In this way we gave relief, we trust, to the pressure upon the trachea, and also released the thyroid gland tissue itself from its heavy compression by this constricting fibrous casing." Convalescence was not remarkable. The pathologic report showed "colloid goiter, with a slight amount of lymphoid tissue; large, irregular follicles, containing considerable colloid, lined by flat cells; with a suggestion of diffuse colloid adenomatous change." The symptoms persisted for a year afterward, then gradually became less and less frequent. There were absolutely no toxic symptoms even under severe

stress and strain. Fifteen months prior to the present observation the patient developed a polyarthritis, and in the course of investigation the tonsils were found to be infected and removed, with definite joint improvement. Five months later, however, the patient began to notice a return of cardiac symptoms, irregularity, precordial uneasiness and pain, paroxysmal tachycardia, and dropped beats; with tremulousness, increased perspiration, irritability, tendency to worry, increased oiliness of the hair, morning headaches, paresthesias, gastric disturbances, etc.

Examination.—*General:* Weight, 179 pounds. Height, 5 feet, $2\frac{1}{4}$ inches. Measurements: Symphysis to soles, $80\frac{1}{2}$ cm.; symphysis to vertex, 81 cm.; span, $164\frac{3}{4}$ cm. Tendency to girdle obesity, fulness through hypogastrium, slight padding over mons. Legs and arms small. *No* subdermal thickening, skin *dry*, with fine desquamation about legs. Mammary development normal. Hands cool, feet cold. Color good. *Hair* fine texture, with increased oiliness. Brownish pigmentation about forehead, limited to hairline, extending down lateral aspects of cheeks and neck, some pigmentation about eyes. No thyroid eye signs. Very *slight* suggestion of supraclavicular *padding*, less so of posterior cervical and axillary regions. Blood-pressure, 115/92. *Regional:* Heart sounds rapid; faint systolic *murmur* at apex, disappearing on inspiration; extrasystoles thrown in at irregular intervals. Systolic murmur of fair intensity in pulmonic area, likewise disappearing on inspiration. Aortic area negative. Pulse, moderately rapid, occasional extrasystole, with prolonged diastolic pause. *Urine* (catheterized) negative. Urine negative for dextrose two hours after 142 gm. dextrose by mouth. *Blood:* Hemoglobin, 95 per cent.; leukocytes, 8600; erythrocytes, 4,144,000; Wassermann negative. *Sugar tolerance:* Blood-sugar after fifteen hours' fast, 0.083 per cent. (normal, 0.10–0.13 per cent.); first hour (after 142 gm. dextrose), 0.153 per cent. (normal, 0.18 per cent.); second hour, 0.10 per cent. (normal, 0.15 per cent.). *Teleroentgenogram:* Vessels, 7.1 cm.; M. R., 5.7 cm.; M. L., 11.2 cm.; T. D., 11.9 cm.; L. D., 20.2 cm., showing slight enlargement of vessels (diffuse) and slight enlargement of heart to left.

Electrocardiograms show minute deflections in three leads, with occasional extrasystole. Lead 3 shows absence of "T" deflection and very small "P" deflection. *Goetsch test* negative. *Basal metabolism*, —19 per cent.

Results of Treatment.—From a clinical standpoint there could be little doubt but that this patient showed definite evidence of hyperthyroidism previous to operation and definite relief from the same. Likewise, a consideration of the history alone at the time of last observation would indicate an exacerbation of the hyperthyroid symptomatology. This opinion is based upon such symptoms as cardiac *palpitation*, *tachycardia*, increased *nervousness*, *irritability*, *apprehension*, and *worry*, increased *perspiration*, oiliness of the *hair*, etc. A determination of the basal metabolic rate, however, disclosed a −19 per cent. A Goetsch test was decidedly negative. On these facts, thyroid substitution was attempted, grain $\frac{1}{4}$ three times a day. The clinical improvement was definite, and two months later a reading of the basal metabolic rate showed a −2 per cent., and the clinical notation states that the patient was subjectively very much relieved.

CASE III

A. B. M. Aged fifty-two. Carpenter. Gen. No. 1655. Referred by Dr. R. Speer, St. Louis.

History.—The patient was perfectly normal until two months ago, at which time, without evidence of any cause in environment, such as psychic trauma, he developed the present symptom-complex: marked nervousness, largely physical, manifest by *tremulousness* of the limbs, especially when attempting to make any physical effort; marked increase in *perspiration;* cardiac *palpitation* and sense of *cervical constriction;* some *excitability; headache*, associated with vertigo; *gastric* distress; slight edema of the ankles and dyspnea after exertion; and increased urinary output, with increased thirst. During the past two months there has been a *rapid loss* of 40 pounds in weight. *Personal:* Tobacco and alcohol in moderation. *Past* and *family histories* negative.

Examination.—Weight, 130 pounds. Height, 5 feet, 5 inches. Measurements eunuchoid. Patient *perspiring* profusely. Con-

siderable *pigmentation* over entire body. *Regional: Hair* very *fine* texture, oily; frontal *alopecia*. Eyebrows thin. *No thyroid eye signs.* Diffuse *enlargement of thyroid*, isthmus distinctly palpable. Veins of neck prominent, *vigorous* arterial *pulsation* over carotids. Apex-beat *tumultuous*, loud systolic murmur at apex, transmitted into axilla, practically disappearing on inspiration. Loud *systolic murmur* in *pulmonic area*, which completely disappears on deep inspiration. Pulse rapid, increased volume; marked shock in forearm, *Quincke positive*. Blood-pressure, 125/85. *Urine* (single specimen): Specific gravity 1026, sugar negative, faint trace of albumin, occasional granular cast and leukocyte. *Functional kidney test:* First hour, 55 per cent.; second hour, 10 per cent.; drug appeared in eight and one-half minutes. *Blood:* Hemoglobin, 107 per cent.; leukocytes, 3400; erythrocytes, 9,620,000; Wassermann negative. *Sugar tolerance:* Blood-sugar after fifteen hours' fast, 0.088 per cent. (normal, 0.10–0.13 per cent.); first hour (after 1.59 gm. dextrose per kilogram of body weight), 0.177 per cent. (normal, 0.18 per cent.); second hour, 0.16 per cent. (normal, 0.15 per cent.). *Teleroentgenogram:* Vessels, 7 cm.; M. R., 6.7 cm.; M. L., 7.3 cm.; T. D., 14 cm.; L. D., 15.5 cm. (indicating slight dilatation of vessels and moderate enlargement of right side of heart). *Electrocardiograms* did not indicate right or left ventricular preponderance. *Basal metabolism*, +79 per cent.

This case, presenting a marked physical breakdown at the age of fifty-two, with rapid loss of weight, might be suggestive of *general arteriosclerosis*, or, in consideration of certain cardiovascular findings, of *specific disease*. Other clinical and laboratory evidence, however, negates the same, and, in the presence of such a decided increase in the basal metabolic rate, we are forced to the diagnosis of *hyperthyroidism*, rather an uncommon occurrence in the male at this age.

CASE IV

A. B. M. Aged thirteen. Gen. No. 1656. Referred by Dr. L. B. Clarke, Atlanta, Ga.

History.—The patient was normal at birth, and began walking and talking at nine months. The first tooth appeared at

four to six months. He has gradually been *gaining weight*, having gained 24 pounds during the past year. Frontal *headaches* are almost constant. The patient is also subject to *constipation* and *dyspnea* on exertion. There is marked underdevelopment of the *genitalia* and secondary sex characters. Considerable obstinacy and decided mental determination have been traits of the patient. He was hard to handle at school, and difficult to control at home. He formerly was unsociable,

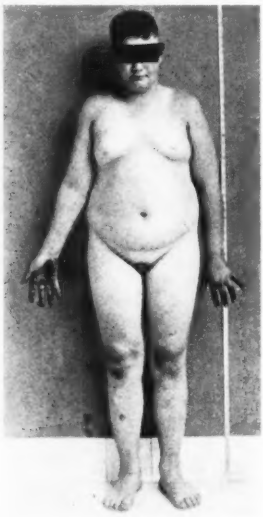

Fig. 73.—Case IV. Note adiposity about mammæ, hypogastric and mons padding, fulness of upper thighs, and aplasia of genitalia.

but at the present time tends to seek companions. Treatment, in the form of pituitary and thyroid, was administered for six months (until five months ago), and during this period he gained 24 pounds in weight. *Past:* Pertussis, measles at age of three. Adenoidectomy and tonsillectomy eight years ago. *Family:* Father died at age of fifty-two, *diabetes*. Mother had four *miscarriages*.

Examination.—*General:* Weight, 176 pounds. Height, 5

feet, 3½ inches. Measurements: symphysis to soles, 85 cm.; symphysis to vertex, 78½ cm.; span, 165 cm. Typically hypopituitary, bilobar variety: girdle obesity, fulness across lower abdomen, through hips, and padding over mons, obesity extending to lower portions of thighs, legs proportionately small. Slight subdermal thickening, slight dryness and desquamation. Few pubic hairs, no axillary hair. Genitalia very small. Pulse, 64. Temperature, 98° F. Blood-pressure, 110/60. *Regional:* Nose shows very slight tendency to high saddling, some flaring across bridge. Thyroid not enlarged. Systolic murmur in pulmonic area, which disappears completely on deep inspiration. Scrotum very small, testes palpable, very small, veins not made out, epididymi not distinguished, penis short, glans well developed. *Urine* (twenty-four-hour specimen): 1200 c.c., specific gravity 1022, sugar negative, faint trace of albumin, microscopic negative. *Blood:* Hemoglobin, 83 per cent.; leukocytes, 7900; erythrocytes, 5,040,000; *Wassermann positive*, 4 plus (cholesterin and alcoholic antigens). Differential count: Polymorphonuclears, 58 per cent.; eosinophils, 1 per cent.; small *lymphocytes*, 32 per cent.; large lymphocytes, 4 per cent.; transitionals, 3 per cent.; mononuclears, 2 per cent. *Sugar tolerance:* Blood-sugar after fifteen hours' fast, 0.087 per cent. (normal, 0.10–0.13 per cent.); first hour (after 140 gm. dextrose), 0.154 per cent. (normal, 0.18 per cent.); second hour, 0.133 per cent. (normal, 0.15 per cent.). *Sella turcica* normal. *Basal metabolism*, —15.4 per cent.

The above case, under our classification, is a classical preadolescent bilobar hypopituitarism, with a very mild secondary hypothyroidism. The presence of a well-controlled 4-plus Wassermann reaction suggests the etiology.

CASE V

A. T. M. Aged seven. Gen. No. 1260. Referred by Dr. J. C. Kopelowitz, St. Louis.

History.—The patient weighed *12½ pounds* at birth. The first tooth appeared at six months, and the patient commenced talking at twelve, and walking at fourteen months. One year

ago he noted considerable muscular twitching about the body. He has gained 10 pounds in weight during the last eight weeks, and his mother is definite in the statement that the *genitalia* have always been small, never having developed in proportion to the remainder of the body. The boy has a ravenous appetite,

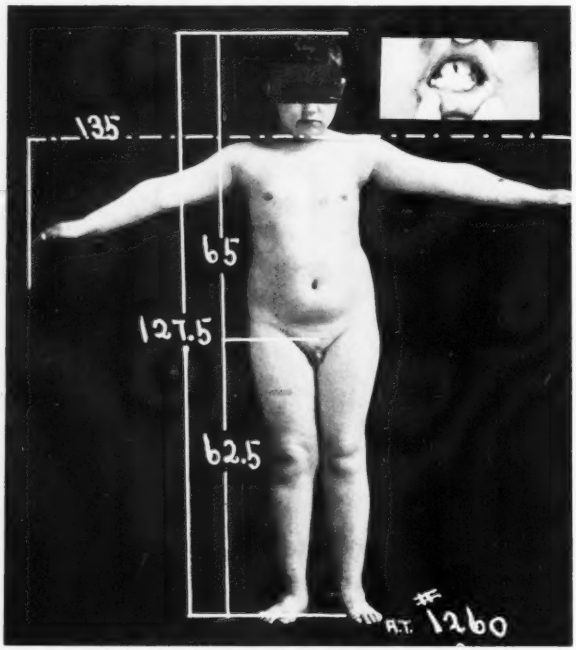

Fig. 74.—Case V. Note tendency to hypogastric and mons padding, fulness of upper thighs, genu valgum, and aplasia of genitalia.

eating more than the ordinary adult, without definite polydipsia or polyuria.

Examination.—*General:* Weight, $85\frac{1}{2}$ pounds. Height, 4 feet, $3\frac{1}{2}$ inches. Measurements: lower, $62\frac{1}{2}$ cm.; upper, 65 cm.; span, 135 cm. General development short, with definite tendency to *obesity*, of *girdle* type. Suggestion of padding through

hips, in hypogastrium, and over mons. Slight subdermal thickening. Hands small, palms broad, fingers rather long, dorsal padding. *Regional:* Upper central *incisors* large and widely *separated*, lateral small and separated; some decay of teeth. Considerable enlargement of breasts. Short, rough systolic murmur in pulmonic area, which disappears on complete inspiration. *Scrotum* very small, *testes* not made out, *penis* extremely short, glans well formed. *Blood:* Hemoglobin, 88 per cent.; leukocytes, 7600; erythrocytes, 4,770,000; Wassermann negative. *Sugar tolerance:* Blood-sugar after fifteen hours' fast, 0.074 per cent. (normal, 0.10–0.13 per cent.); first hour (after 72.2 gm. dextrose), 0.133 per cent. (normal, 0.18 per cent.); second hour, 0.117 per cent. (normal, 0.15 per cent.). *Sella turcica* small, distance between anterior and posterior clinoid processes, $2\frac{1}{2}$ mm.; depth, 5 mm. *Radiograph of hand* shows normal development of ossification centers. *Basal metabolism*, —10 per cent.

A diagnosis of preadolescent bilobar hypopituitarism was made, and the patient placed upon the following treatment: Antuitrin hypodermically; pituitrin (O) hypodermically, beginning with a very small dose and increasing until the intestinal reaction occurred, this reaction consisting of abdominal cramping, followed in a short time by defecation (considered the tolerant physiologic dose); anterior lobe pituitary extract, grains $2\frac{1}{2}$, and pituitary substance, entire gland, grains $2\frac{1}{2}$ (one capsule three times a day, after meals). The patient was again seen three months later, and the following notations made: "Patient seems to have grown taller, girdle obesity less marked. Penis somewhat increased in length and general development. Mammary obesity less, axillary padding less marked. Other findings same." The basal metabolism at this time was +7.6 per cent., an *increase* of 17 per cent.

The above illustrates a case of preadolescent bilobar hypopituitarism, presenting classical clinical signs, with a decreased basal metabolism. Three months' substitutional therapy apparently produced important changes in the general make-up, notably a decrease in adiposity and an increase in genital de-

velopment, associated with a definitely *increased* basal metabolism.

CASE VI

A. H. S. Aged thirty-one. Gen. No. 1115. Referred by Dr. W. W. Graves, St. Louis.

History.—Onset occurred one year prior to observation, with marked physical *exhaustion*, inability to do an ordinary day's work, even short walks producing exceptional *fatigue*. There is some *mental* confusion, indecision as to the proper course to pursue. There is marked frequency of urination, the twenty-four-hour output being about $\frac{2}{3}$ gallon, associated with *polydipsia*. *Headache* occurs, *bitemporal*, particularly over the left eye, associated with *visual* disturbance, in the form of scotomata. There is marked *tinnitus* aurium. The patient complains of *pain* in the *nose*, extending from the glabella to the tip, and that the nose is *increasing* in *width*. *Increase* in *size* of the *face* has been noted, particularly above the eyes, the cheek bones, and the lower *jaw*. The *teeth* have been *separating* for the past year, more noticeably in the inferior maxilla. The *tongue* feels *thick* and the *voice* is *changing*, producing some difficulty in articulation. There is gustatory disturbance and perversion of *smell*. The patient has gained 15 pounds during the past three months, the present weight being 225 pounds. Height is 6 feet, $7\frac{1}{2}$ inches. There is aching pain in the extremities, particularly the upper arm and leg. The *hands* and *feet* are transiently swollen, but have shown definite permanent *increase* in *size* during the past year. Definite *loss* of *libido* has been noted during the past year. *Past* and *personal histories* negative. *Family:* One *brother* is 6 feet, 3 inches tall, weighs 190 pounds. *Father* is 6 feet, 3 inches tall. One *sister* is 5 feet, $10\frac{1}{2}$ inches, weighing 300 pounds. Definite tendency on both paternal and maternal sides to increased stature.

Examination.—*General:* Weight, 225 pounds. Height, 6 feet, $7\frac{1}{2}$ inches. Measurements: upper, $95\frac{1}{4}$ cm.; lower, 104 cm.; span, $208\frac{1}{4}$ cm. Size of shoe, 12 EE; of glove, 11. *Mixed type of gigantism*, with secondary *acromegalic* manifestations. Marked separation of upper and lower teeth. Slight chloasma pigmentation. Abnormal distribution of hair across chest. Gen-

italia well developed. Musculature hypertrophic throughout. Hands one-third larger than normal, but well proportioned, no

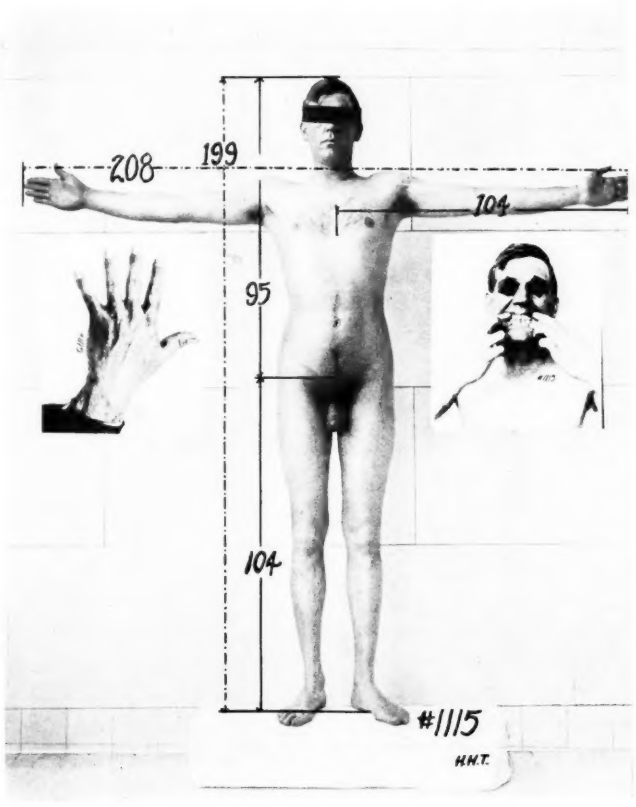

Fig. 75.—Case VI. Note remarkable height, increased length of long bones (as manifested by length from symphysis to soles and of span); marked separation of upper and lower central incisors, and broad, spade-like hand, with short fingers.

marked widening of finger-tips, lunular markings present. Feet of same general character. Pulse normal. Blood-pressure, 119/80. *Regional* examination negative except for local findings

of *gigantism* and *acromegaly*. *Urine* (twenty-four-hour specimen), 5500 c.c., clear, specific gravity 1010, trace of albumin, sugar negative, microscopic negative. *Blood* (including Wassermann) normal. *Carbohydrate tolerance increased:* Blood-sugar after fifteen hours' fast, 0.087 per cent. (normal, 0.10–0.13 per cent.); first hour (after 165 gm. dextrose), 0.131 per cent. (normal, 0.18 per cent.); second hour, 0.108 per cent. (normal, 0.15 per cent.). *Sella turcica:* Anteroposterior diameter, 15 mm.; depth, 15 mm. *x-Ray of hand:* Tufting of distal phalanges, bones exceptionally large and dense. *Electrocardiograms:* Ectopic beat, of ventricular origin. *Basal metabolism:* First reading, +20 per cent. Three successive readings during past eight months as follows: +1 per cent.; +1.71 per cent.; —7.5 per cent.

The above case is a clinical demonstration of preadolescent anterior lobe hyperactivity, productive of gigantism, with an extension of this hyperactivity into the postadolescent years, producing certain clinical features of acromegaly. This case is peculiarly interesting from the standpoint of basal metabolism. For many years the individual progressed in a perfectly normal way, possessing physical strength and accomplishment in proportion to his huge physique, his height being 6 feet, $7\frac{1}{2}$ inches. The primary basal metabolic rate was +20 per cent., at which time the patient was probably still hyperactive. During the past eight months there has been an apparent transition into hypo-acitvity, as manifested by a decided increase in myasthenia, slowed cerebration, and decreased libido. Despite therapy along the lines indicated by the clinical signs, the patient's condition continued to decline, particularly in the way of fatiguability and decreased sexual activity. The last basal metabolic rate was —7.5 per cent. Since this last reading a more intensive substitutional therapy (anterior lobe) has been exhibited, with definite improvement in muscular strength and libido. Since this clinical improvement a basal metabolic determination has not been made. We are inclined to believe that the basal metabolic determinations have kept fairly good pace with the clinical manifestations, giving us a fair index to

this individual's transition from a previously existing hyperactivity into a definite hypo-activity.

CASE VII

P. B. M. M. Aged fifteen. Gen. No. 1438. Referred by Dr. Neil Moore, St. Louis.

History.—The patient was normal at birth. Dentition occurred normally, and locomotion and speech were not remarkable. Development was normal until the age of seven, at which time, following a mild attack of measles, the patient began to gain weight rapidly, reaching 105 pounds at the age of ten, 175 pounds at the age of fourteen, present weight being 205 pounds. This increased *adiposity* has been distributed particularly about the upper thighs and abdomen. At present he complains of occasional *headache* and of being markedly *drowsy* and sleepy during the day. He perspires easily, and states that his hair grows very rapidly. Other symptoms are indefinite *visual* disturbance, increased *thirst*, without polyuria, and some tendency to *constipation*. The mentality is normal for the age, without tendency to decreased cerebration. Diffuse superficial tenderness exists over the entire body. *Past:* Measles at age of seven, to which patient dates adiposity. Questionable malaria. *Personal history* unimportant. *Family: Father* 6 feet in height, weighing 300 pounds. Mother possessed normal endocrinous make-up.

Examination.—*General:* Weight, 205 pounds. Measurements: symphysis to vertex, 85 cm.; symphysis to soles, $82\frac{1}{2}$ cm.; span, $168\frac{1}{2}$ cm. Very marked *adiposity*, more or less universal, but definitely increased about *girdles*, pelvic and shoulder, and upper portions of *thighs*. *Mammæ* overdeveloped. Very slight amount of *hair* in axillæ and over mons; lanugal growth on face. Head small. Hands fairly well developed, normal size. No definite pigmentation. Very marked *genital aplasia*, particularly of penis. Measurements: bust, 100 cm.; level of navel, $102\frac{3}{4}$ cm.; level of anterior, superior spine, $110\frac{1}{4}$ cm.; thigh, upper third, $68\frac{1}{2}$ cm.; middle of leg, 38 cm. Diffuse hyperesthesia over entire body. Pulse, 80. Blood-pressure, 140/80. *Regional:*

Frontal *incisors* slightly *separated*. Teeth generally show early decay. Thyroid not palpable. Slight systolic *murmur* at apex, *disappearing* on complete inspiration. Similar murmur, with same characteristics, in *pulmonic* area. Large fat folds along lateral upper aspects and lower portion of abdomen. *Urine*

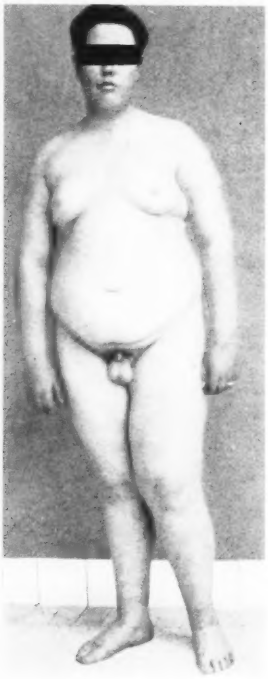

Fig. 76.—Case VII. Note mammary adiposity, marked padding over hypogastrium, mons, and upper thighs, genu valgum, and aplasia of penis.

negative. *Blood:* Hemoglobin, 95 per cent.; leukocytes, 10,500; erythrocytes, 5,420,000; Wassermann negative. *Carbohydrate tolerance:* Blood-sugar after fifteen hours' fast, 0.054 per cent. (normal, 0.10–0.13 per cent.); first hour (after 1.59 gm. dextrose per kilogram of body weight), 0.132 per cent. (normal, 0.18 per cent.); second hour, 0.068 per cent. (normal, 0.15 per cent.).

Sella turcica normal. *Skiagraph of hand* shows normal carpal, metacarpal, and phalangeal bones; no tufting or mushrooming. *Antuitrin thermic test* was productive of 0.2 degree rise in temperature in fifteen hours. *Basal metabolism*, —18 per cent.

The above is rather a classical example of *bilobar hypopituitarism*, exhibiting hormonic signs of both anterior and posterior lobar deficiency (*genital aplasia* and *adiposity*). There is no clear-cut clinical evidence suggesting an associated hypothyroidism. Of interest is the onset of hypophyseal deficiency following the acute infection, *measles*. The basal metabolism, as noted above, is —18 per cent. The patient was placed upon substitution treatment, the results of which are at present unknown.

CASE VIII

H. R. M. Aged forty. Gen. No. 1488. Referred by Dr. Robert Hyland, St. Louis.

History.—For the past ten years the patient has noticed a gradual *increase* in size of the *hands* and *feet*, noticed particularly in purchasing gloves and shoes. There has been a gradual *separation* of the lower *teeth*, with an increasing *prognathism* of the lower jaw. In recent years there has been a tendency to unilateral *headache*, centered with greatest intensity in the region of the left ear. There has been a slowly developing *kyphosis*, with more marked scoliosis of the lower thoracic vertebra. The above manifestations have been of very little concern to the patient, but a gradually increasing *fatiguability* and *muscular weakness* for the past two years have been a source of much concern. Associated with this increased fatiguability and myasthenia has been a *gain in weight* of 15 or 20 pounds in the past twelve months, and some recent *loss of libido*. There is no visual disturbance. The patient's wife verifies the above facts, particularly the *increased* development of *brows*, *nose*, *chin*, *hands*, and *feet*, the separation of the *teeth*, and the gradually progressive *muscular* weakness. In addition, she states the mentality has shown an increased tendency to *depression*. *Past: Measles* in childhood. *Personal:* Unimportant. *Family:* No children. *Father* and one *sister acromegalic* types.

Examination.—*General:* Measurements: Upper, $91\frac{1}{4}$ cm.; lower, $96\frac{1}{4}$ cm.; span, $205\frac{1}{2}$ cm. Extremities markedly out of proportion. *Hands* typically *acromegalic*, palms broad, fingers short and blunt. Circumference of palm, $10\frac{1}{2}$ inches ($26\frac{1}{2}$ cm.). Feet of same character. No marked abnormal distribution of

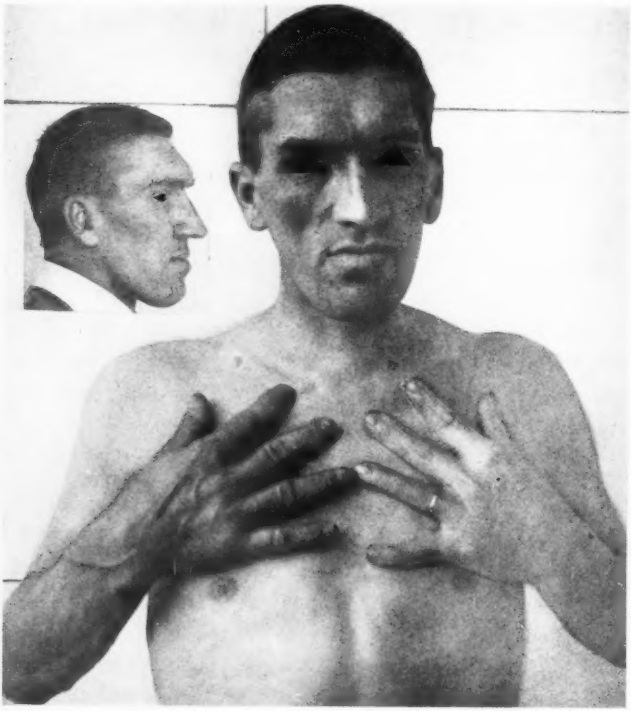

Fig. 77.—Case VIII. Note prominence of supraciliary ridges and nose, and prognathism of the jaw; typical acromegalic hands.

hair about body or extremities. *Face* acromegalic type, very marked prominence of supraciliary ridges (seeming to project above level of skull distance of 2 cm.), eyes deep-set, *nose* very *large, jaw* markedly *prognathous*, chin *blunted*. Slight chloasma pigmentation about forehead, limited to hairline, extending

down to neck. *Regional:* Eyebrows bushy, meet in midline. *Thyroid*, particularly isthmus, definitely *enlarged*, moderately *soft*. Rough systolic *murmur* at apex, soft murmur in pulmonic area, both of which *disappear* on deep inspiration. *Urine* negative. *Blood:* Hemoglobin, 70 per cent.; leukocytes, 6200; erythrocytes, 3,970,000; Wassermann negative. *Carbohydrate tolerance test:* Blood-sugar after fifteen hours' fast, 0.08 per cent. (normal, 0.10–0.13 per cent.); first hour (after 1.59 gm. dextrose per kilogram of body weight), 0.126 per cent. (normal, 0.18 per cent.); second hour, 0.094 per cent. (normal, 0.15 per cent.). *Skiagraph, transverse view of skull* shows very slight *enlargement* of sella turcica. *Skiagraph of hand* shows thick, heavy metacarpals and phalanges, with marked *mushrooming* and *tufting* of terminal phalanges; *overgrowth* of normal osseous *protuberances*. *Basal metabolism*, +3 per cent.

The above case, as may be noted from the figure, is a frank case of acromegaly, or postadolescent anterior lobe hyperpituitarism. The entire symptomatology was not remarkable, except for the gradual development of fatiguability, muscular weakness, and decreased libido. We believe these latter features indicate what so commonly occurs, namely, the transition of hypophyseal hyperactivity into a state of hypoactivity. Cushing maintains that the sugar tolerance is decreased in acromegaly, and the increased tolerance in this case would indicate transition. Magnus-Levy and other observers found an increased basal metabolism in acromegaly. The normal basal metabolic rate in this condition might likewise indicate transition, although it is probably presumptuous to assume that this individual would have shown an increased basal metabolic rate had he come under observation during his hyperactivity.

CASE IX

B. J. S. F. Aged twenty-seven. Gen. No. 354.

History.—For the past year the patient has been complaining of a marked *fatiguability* and *lassitude*. Slight effort is sufficient to produce fatigue. The *hands* and *feet* are always *cold*, and the hands perspire freely. There is tendency to increased *nervous-*

ness and *irritability*. Amenorrhea has been present for two or three months. The periods ordinarily were regular. *Past: Measles* in childhood, *typhoid* at age of twelve, influenza six months ago. *Personal* and *family:* Unimportant.

Examination.—Classical *eunuchoid* type, very *tall* and *slender*, with *no* adiposity. Long bones overdeveloped. Hands *long* and *narrow*, *fingers* extremely *long*, classical wrists. Feet of same

Fig. 78.—Case IX. Note remarkably tall, slender figure, absence of adiposity, increased length of long bones, sharp chin, and long, tapering fingers.

general type. Profile classical, *chin sharp* and *pointed*. Slight pigmentation about forehead, that is not a definite chloasma. No abnormal hair distribution. Measurements: Upper, 76 cm.; lower, $88\frac{3}{4}$ cm.; span, $168\frac{1}{2}$ cm. Thyroid not palpable. *Uterus* small, not infantile; external genitalia normal. *Urine* negative. *Blood:* Leukocytes, 11,400; erythrocytes, 4,500,000; stained smear, relative increase in small lymphocytes; Wassermann

negative. *Carbohydrate tolerance:* Blood-sugar after fifteen hours' fast, 0.053 per cent. (normal, 0.10–0.13 per cent.); first hour (after 1.59 gm. dextrose per kilogram of body weight), 0.125 per cent. (normal, 0.18 per cent.); second hour, 0.068 per cent. (normal, 0.15 per cent.). *Basal metabolism,* —13 per cent.

The succeeding clinical notes are largely concerned with the *irregular menses, delayed onset,* occurring every five to six weeks, *scanty* flow, without dysmenorrhea. Very marked increase in fatiguability and occasional headache persist.

The above case is rather a classical eunuchoid type, displaying clinical evidence of ovarian insufficiency, with absolutely no evidence of thyroid or pituitary hypo-activity. It will be noted that the sugar tolerance was definitely increased, and the basal metabolism definitely decreased. It must be stated, however, that our primary gonadal insufficiencies, as a rule, have not shown such a decided decrease in the basal metabolic rate.

CASE X

C. G. M. Aged twenty-one. Gen. No. 1145.

History.—The patient states that for the past five years he has been suffering from migraine *headaches,* hemicranial in type, associated with nausea and vomiting, increasing *constipation, loss of hair,* and loss of weight. There is increased *excitability,* tendency to *worry* about trifles, fine *tremor* of the extended hand and fingers, hot *flushes,* and *coldness* of the *hands* and *feet. Libido* has decreased. *Past:* Diphtheria at age of seven. Measles. *Family history* unimportant.

Examination.—*General:* Measurements: Lower, 78½ cm.; upper, 79¾ cm.; span, 170 cm. General development definitely *undersized,* particularly *osseous* development. No abnormal distribution of hair. Faint brownish pigmentation about forehead and lateral aspects of cheeks and neck. Entire make-up one suggestive of *infantilism,* with general *osseous underdevelopment,* without genital aplasia. *Regional:* Slight thyroid fulness. Harsh systolic *murmur* at apex and in *pulmonic* area, *disappearing* on inspiration. *Urine* negative. *Blood:* Hemoglobin, 118 per cent.; leukocytes, 9800; erythrocytes, 7,800,000; Wassermann

negative; stained smear normal. *Basal metabolic rate*, —31 per cent.; after treatment, +.8 per cent.

On the basis of a perfectly proportionate but definitely underdeveloped osseous system, and in the absence of other signs suggesting thyroid or posterior lobe pituitary deficiency, a tentative diagnosis of *partial* anterior lobe pituitary hyposecretion was made, and the medication was *confined* entirely to the substitution of this portion of the gland. The case quoted is of *interest* because of the fact that, after six weeks' treatment of anterior lobe pituitary substance, $2\frac{1}{2}$ grains three times a day, and antuitrin (Parke, Davis & Co.), 1 c.c. twice weekly hypodermically, the patient's metabolic rate was increased 30 per cent., with an *associated improvement* in general nervousness, headaches, constipation, flushing, coldness of the extremities, etc.

To conserve time the remaining cases will be tabulated, stating the clinical diagnoses based upon the hormonic signs; the basal metabolic rate, and the sugar tolerance. The insertion of the carbohydrate tolerance findings we believe is justified by the interest that naturally exists in a comparative study of sugar tolerance and the basal metabolic rate. Concerning the value of carbohydrate tolerance in the study of endocrine disturbance there is likewise a marked divergence of opinion. Howard, in his study of acromegaly and other disturbances of the hypophysis, states that a decrease in the sugar tolerance in the presence of other disturbing symptoms of pituitary function justifies a diagnosis of increased activity of the pars intermedia. Abrahamson and Climenko, in a study of 100 cases of pituitary disease, conclude that the secretion of the pituitary gland does not influence sugar metabolism, and that sugar tolerance is not a valid criterion of pituitary disease. McCaskey believes that an alimentary hyperglycemia, following the ingestion of 100 grams of glucose, is present in probably every case of thyrotoxicosis, and is rarely present at the end of the first hour in normal individuals. He believes that its presence at the end of one hour, and particularly at the end of two hours, always indicates abnormal carbohydrate metabolism, unless gastro-intestinal function is delayed. He admits there is no direct ratio between the intensity of the hyper-

thyroidism and the height of the alimentary hyperglycemia, although in general the blood-sugar values in severe cases are high, and sounds a note of warning that too much importance should not be attached to alimentary blood-sugar values below 140 mg. of sugar in 100 c.c. of blood. Rodenberg, Bernhardt, and Kroebel recognize three reaction types, and believe there is no fixed type of reaction even in metabolic disturbance, similar curves having been found in conditions as widely different as diabetes, tuberculosis, epithelioma, and pregnancy. In the following cases the blood-sugar was estimated in the postabsorptive state after fifteen hours' fast; 1.59 gm. of dextrose per kilogram of body weight were given, and a blood-sugar estimation made at the end of one hour and again at the end of two hours. With some trepidation we adopted an arbitrary normal curve: before the ingestion of glucose from 0.10 to 0.13 per cent.; at the end of the first hour, 0.18 per cent.; at the end of the second hour, 0.15 per cent. A decreased tolerance was considered one which would produce a higher curve during the two hours' estimations than the normal, and an increased tolerance would show figures below this standard curve. Under ordinary circumstances one would expect an increased basal metabolism to be associated with a decreased sugar tolerance, and vice versa. In the appended tables many discrepancies in this respect will be noted, and we are inclined to accept the basal metabolic reading as the more accurate index to endocrine activity, and believe that sugar tolerance alone as an index to physiologic activity will never be of more than questionable value until properly correlated with suitable collateral determinations of blood volume and of other factors that may modify sugar concentration. The cases studied have been arranged according to their clinical diagnoses into the following groups:

Hyperthyroidism.

Hypothyroidism.

Hypopituitarism (anterior lobe and bilobar).

Diabetes insipidus (pars intermedia and pars posterior insufficiency).

Hyperpituitarism.

Polyglandular insufficiency.

HYPERTHYROIDISM [1]

	Basal metabolism, per cent.	Sugar tolerance		
		Post absorptive state, per cent.	First hour, per cent.	Second hour per cent.
1	+18	.086	.128	.088
2	+ 2	.110	.200	.190
3	+72	....	....	....
4	− 2	.128	.130	.136
5	+46	.120	.222	.180
6. (Clinical hyper-)	−12	.114	.168	.110
7	+39	.132	.276	.222
8	+19	.096	.118	.112
9	+41	.108	.148	.146
10	−10	..	....	....
11	+22	....	....	....
12	+36	....	....	....
13	Normal	....	....	....
14	+50	....	....	....
15	+13	....	....	....
16	− 2	....	....	....
17	+11	....	....	....
18	+24	....	....	....
19	+18	.080	.140	.160
20	+103	.090	.147	.135
21	+7	.105	.189	.153
22	+13	....	....	....
23	+18	....	....	....
24. (Mild)	+7	....	....	....
25	+2	.083	.150	.100
26	+13	.116	.217	.168
27	+1.8	.100	.250	.150
28	+13.6	....	....	....
29	−4.3	.100	.117	.117
30	+16.4	....	....	....
31	+7.26	....	....	....
32	+17.6	.107	.235	.181
33. (Diabetes)	+12	....	....	....
34	+15	....	....	....
35	+12	.105	.156	.171
36	+14	....	....	....
(Two weeks later)	+32	.128	.130	.136
37	+20	.110	.200	.190
38	+30	....	....	....
39	+79	.088	.177	.160
40	+26	.125	.250	.139

[1] We are indebted to Miss E. K. Sands for the majority of the technical determinations.

In the foregoing list of 40 cases of hyperthyroidism but very few discrepancies are to be noted. Case 6, one of the interesting borderline types in which the basal metabolism is most valuable, presented a somewhat clear-cut clinical picture of hyperthyroidism, the basal metabolism, however, showing a —12 per cent., with an increased sugar tolerance. Case 10 at the time of observation presented a doubtful clinical picture, with a basal metabolism of —10 per cent. The subsequent course, however, has led us to believe the case to have been a hypo- rather than a hyperthyroidism. Cases 4, 16, 27, and 29, although diagnosed clinically as hyperthyroidism, showed minus readings, within the normal variation. Case 25, originally considered hyperthyroid, proved to be a case of pulmonary tuberculosis.

It will be noted there is considerable discrepancy in the basal metabolic rate as compared with the carbohydrate tolerance. It will be further noted, however, that in cases showing a *very decided* increase in the basal metabolic rate there was usually a definitely decreased carbohydrate tolerance.

In the 39 cases of hypothyroidism shown on p. 808 there is a rather consistent decrease in the basal metabolic rate, with an occasional discrepancy. Case 1, presenting a B. M. R of plus 15 per cent., was classically a hypothyroid type, and despite the increased rate was placed upon thyroid therapy, with gratifying clinical response. Cases 12, 15, 17, 23, 24, and 35 were hypothyroid types upon whom increased basal metabolic rates were obtained after thyroid had been administered. Case 7 was clinically hypothyroid, with a B. M. R. of plus 19 per cent. The subsequent course of this case is not known. The lowest basal metabolic rate in this series was a —39 per cent., in a case of frank myxedema (Case 37), who also showed a definitely increased carbohydrate tolerance.

HYPOTHYROIDISM

	Basal metabolism, per cent.	Sugar tolerance		
		Post absorptive state, per cent.	First hour, per cent.	Second hour, per cent.
1.	+15	....	....	....
2.	−13	.122	.148	.110
3.	−15	.114	.184	.174
4.	−23	.108	.118	.118
5.	−21	....	....	....
	−12	....	....	....
6.	−28	.100	.148	.146
7.	+19	.128	.150	.124
8.	+5	.108	.130	.126
9.	−18	....	....	....
10.	+.1	.119	.176	.160
11.	−1	....	....	....
12.	+4	....	....	....
13.	−8	....	....	....
14.	−7	....	....	....
15.	−23	.120	.246	.180
(After treatment)	+10	....	....	....
16.	−13	....	....	....
17.	+10	.096	.100	.084
18.	−4	.120	.144	.111
19.	−12	....	....	....
20.	+.2	.123	.186	.186
21.	−13	.090	.110	.090
22.	−5	.086	.071	.080
23.	+11	.087	.222	.170
24.	+15	.080	.105	.090
25.	−13	.080	.133	.100
26.	−24	.136	.231	.153
27.	−.3	.105	.166	.153
28.	−7.6	.142	.294	.280
29.	+6.2	.128	.121	.210
30.	−9.2	.088	.146	.090
31.	−16	.088	.150	.147
32.	−18	.105	.194	.139
33. (Pre-operative hyper-)	−19	.083	.153	.100
(Two months later)	−2	....	....	....
34.	−10	.077	.142	.105
35.	−7	.804	.168	.162
(Seven months later, on treatment)	+30	....	....	....
36. (Hypertension, systolic 225)	−6	.060	.117	.133
37. (Myxedema)	−39	.100	.118	.100
38.	−2.8	.102	.178	.145
39.	−8	....	....	....
(One month later)	+22	....	....	....

HYPOPITUITARISM

	Basal metabolism, per cent.	Sugar tolerance		
		Postabsorptive state, per cent.	First hour, per cent.	Second hour, per cent.
Anterior lobe:				
1	−.3	.102	.180	.120
2	−30	....	....	....
(After treatment)	+.8	....	....	....
3. (Pernicious anemia)	+17	....	....	....
4	+4	.096	.100	.070
5	−2	....	....	....
6	+15	....	....	....
7	+14	.120	....	.160
8	−12.7	.070	.127	.150
Bilobar:				
9	−18	.054	.132	.168
10	−2	.096	.250	.235
11	−13	....	....	....
12	+9.5	.054	.100	.088
13. (On treatment)	+13	.110	....	....
14. (Petit mal)	−22	....	....	....
15	+7	.132	.150	.120
16	−.8	.090	.096	.111
17	+16	.102	.129	.120
18	−5	.144	.162	.130
19	−.2	....	....	....
20	+7.6	....	....	....
21	−10	.074	.133	.117
(On treatment)	+7.6	....	....	....
22	+12	.138	.252	.237

The majority of cases of clinical hypopituitarism, particularly the bilobar variety, showed a decreased basal metabolic rate. Case 2, quoted more fully in the text, is remarkable because of the increase from a —30 per cent. to a plus .8 per cent., on pure anterior lobe pituitary treatment. Case 3, showing a plus 17 per cent., was complicated by a pernicious anemia. Case 6, a classical anterior lobe deficiency, presenting both osseous and genital underdevelopment, gave a reading of plus 15 per cent., although some treatment had been administered previous to this observation. Among the bilobar cases, displaying evidence of both anterior and posterior lobe deficiency, Case 22 showed the most marked discrepancy, manifesting a plus 12 per cent. and a remarkably decreased sugar tolerance.

DIABETES INSIPIDUS

(Deficiency of Intermediate Lobe)

	Basal metabolism, per cent.	Sugar tolerance		
		Postabsorptive state, per cent.	First hour, per cent.	Second hour, per cent.
1	−.5	.130	.156	.112
2	−8	.105	.144	.096
3	+3.3	.117	.195	.162
4	+12	.100	.082	.116
5	+20	.104	.261	.222
(After treatment)	−7.5	.087	.131	.108
6	+6.2	.300	....	....

The above cases show no consistency in the basal metabolic rate. Of decided interest is Case 5, who not only presented the syndrome of diabetes insipidus, but, in addition, was an acromegalic giant, beginning to show evidence of transformation into hypo-activity. As will be noted, the first reading, a plus 20 per cent., was associated with a definitely decreased carbohydrate tolerance, and a reading taken eight months later showed a basal metabolic rate of —7.5 per cent., and a definitely increased sugar tolerance.

HYPERPITUITARISM

	Basal metabolism, per cent.	Sugar tolerance		
		Postabsorptive state, per cent.	First hour, per cent.	Second hour, per cent.
1	+42	.080	.160	.110
2	−12	....	....	....
3	+11	....	....	....
4	+4	.128	.300	.136

In the above list Cases 1 and 3 showed an associated hyperthyroidism, although the pituitary manifestations were predominant. Case 2, displaying a basal metabolic rate of —12 per cent., was a classical eunuchoid giant with definite evidence of preadolescent hyperactivity, although at the time of observation there had been a definite transposition into a state of hypo-activity, as manifested by decreased mentality, muscular fatiguability, loss of libido, and other minor signs of decreased function. His primary hyperactivity persisted in the form of gross physical changes of the osseous system, etc.

POLYGLANDULAR INSUFFICIENCY

	Basal metabolism, per cent.	Sugar tolerance		
		Postabsorptive state, per cent.	First hour, per cent.	Second hour, per cent.
1.	+4	.110	.159	.141
2. (Anterior lobe, pituitary, and gonad)	−28	.110	.180	.120
3. (Pituitary and gonad)	+1	....	....	....
4. (Pituitary and gonad)	−11	.098	.252	.141
5.	−8	....	....	....
6. (Posterior lobe)	−25	.136	.231	.153
7. (Thyroid and gonad)	+2	.105	.200	.181
8. (Thyroid and gonad)	+1	....	....	....
9. (Pituitary and gonad, with epilepsy)	+2	.108	.117	.105
10. (Pituitary, thyroid, and gonad)	−12	.074	.105	.112
11. (Pituitary and gonad)	−4	.093	.222	.153
12. (Pituitary, thyroid, and gonad)	+5.39	....	....	....
13. (Pituitary, thyroid, and adrenal)	+4.83	.100	.160	.100
14. (Pituitary and thyroid, with pituitary headache)	−4.8	.079	.195	.162
15. (Pituitary and thyroid)	−29	.105	.100	.105
16. (Thyroid, gonad, and pituitary)	−16	.080	.173	.183
17. (Pituitary and thyroid)	−5.7	.161	.219	.177
18. (Pituitary and thyroid, with epilepsy)	−13	.064	.125	.064
19. (Thyroid, pituitary, and gonad)	−15.4	....	....	....
20. (Pituitary and thyroid —on treatment)	−1	....	....	....
21. (Pituitary and thyroid)	−5	.120	.192	.213
22. (Thyroid and pituitary)	−11	.081	.141	.096

It will be noted that in the cases of polyglandular insufficiency the basal metabolic rate has been consistently decreased. The most notable decreases have occurred in cases in which there was an associated hypothyroidism.

The foregoing tables, even with the discrepancies impossible of explanation, lead to the conclusion that determinations of the

basal metabolic rate are valuable in the study of endocrine disturbances, and that determinations of carbohydrate tolerance are of a *definitely lesser value*. Despite the fact that the method is being severely criticized, and even discarded by some observers, we feel that determinations of the basal metabolic rate are destined to become an integral part of diagnostic procedure not only in the measurement of thyroid activity, but in the determination of pluriglandular, pituitary, and possibly gonodal and adrenal activity as well. Hitherto we have been accustomed to base our diagnoses of endocrine disorder almost entirely upon the hormonic signs and symptoms, that is, physical changes such as gross deviation in the osseous and genital systems, and the coarser manifestations of metabolic perversion, such as obesity. It must be remembered that the physical characteristics and signs give evidence of certain endocrine states, but it must also be recalled, as Marie long ago pointed out, that a *hyperactivity* may be *transformed* into a *hypo-active* state, *retaining* the *physical characteristics* of *hyperactivity*, but *possessing* the *physiologic functions* of *hypo-activity*. The basal metabolic rate will enable us, we believe, to determine the physiologic activity of certain glands at the *time of observation*, independently of what their previous activities may have been. This determination of *physiologic* activity at the *time of observation* is of paramount *importance*, because it is, we believe, the most reliable index to diagnosis, prognosis, and, what is of greater importance, proper therapy.

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ENDOCARDITIS

WE are very fortunate to be able to consider today a case which, together with the case of bacterial endocarditis which was presented last week, reveals the subject of endocarditis in a very striking manner. For each case displays the features which distinguish the two chief types of this disease. In order to make the comparison more emphatic we will review the previous case and consider its autopsy findings, and then take up the present case.

CASE I

(Presented by student who had had the case.) Male; white; age forty-six; teamster.

Chief Complaint.—Weakness, pain in left side, beneath lower ribs, and painful joints in right hand and left foot, and dyspnea.

Onset and Duration.—Patient says "he has been failing" for the past two months. Noticed that he was beginning to tire easily. Occasionally felt feverish. Weakness became more prominent and for past four weeks has been short of breath on exertion. About three weeks before entering hospital small red painful swellings were noticed at interphalangeal joints in right hand and in left foot. These swellings would subside in about six days. During past month fever has been continuous, weakness has steadily increased. Suddenly, three days before admission, sharp sudden pain in left side.

Other Symptoms.—Cerebral, occasional sensation of giddiness; gastro-intestinal, occasional nausea without vomiting. G.-U.: No disturbance.

Past History.—Measles the only disease of childhood recalled. At seven patient had severe attack of acute rheumatic fever which kept him in bed for one month. Thereafter patient noticed slight dyspnea on exertion and has always been told by doctors that he had a "leaky heart." Had rheumatism again at ages of sixteen and twenty. Is subject to frequent attacks of tonsillitis. No other disease recalled by patient. Denies venereal infection. Has been employed as a teamster for past fifteen years, discharging his duties in that occupation with slightly increased difficulty during past few years due to shortness of breath on extra exertion. Has occasionally had swelling of the feet, but this has never been present for more than a few days at a time. Patient has maintained a weight of 146 pounds.

Physical Examination.—Briefly, the outstanding features are as follows: Patient is fairly well developed and nourished. A noticeable greenish pallor is present in the skin over the entire body, more particularly in the face. Scattered over both extremities were many petechial spots, some with whitish centers.

Eyes, including fundi and ocular movements, normal. Gums show extensive pyorrhea. Tonsils slightly enlarged, but not inflamed. Facial movements normal. Jugular pulsations in the neck prominent. Lymph-nodes at angle of jaw palpable and slightly enlarged.

There was marked dyspnea, rate 28. Respiratory excursions symmetric. Râles at both bases. Occasional cough, with mucopurulent sputum containing a moderate number of pus-cells and chains of Gram-positive diplococci as the most prominent bacteria. There were no definite, localized lung findings.

There was a systolic murmur at the apex, a diastolic murmur in the aortic area, and radiogram showed the heart to be markedly dilated.

The spleen was enlarged and extremely tender, this being the seat of the pain of which the patient complained.

One small joint in the right hand showed redness, acute tenderness, and slight swelling.

Culture: Streptococcus viridans 450 colonies per cubic centimeter of blood. Two subsequent cultures showed about the

same degree of bacteriemia. A culture just before death showed a countless number of colonies. In drawing blood for culture it was noticed that some allowed to clot yielded a large amount (about two-thirds of the total volume) of serum, and this serum had a faint but definite greenish tinge.

Urine showed trace of albumin, red blood-cells, pus-cells, and the culture showed pure growth of Streptococcus viridans.

Blood: Wbc., 14,000; Rbc., 3,400,000; Hb., 55 per cent. Kidney function test: 40 per cent. in two hours. Wassermann negative.

Diagnosis.—The diagnosis made was streptococcus bacteriemia due to bacterial endocarditis. It was decided that there was septic embolism of the spleen and infection of the kidneys. The vegetations were thought to be on the mitral and aortic valves. The prognosis was considered fatal, and because of the embolism in the spleen it was thought that death could occur at any time by further embolism. The patient died four days after admission, death being preceded by signs of cerebral embolism. At autopsy a large friable vegetation engaged the aortic orifice, having its origin on one of the cusps. It involved the nearest cusp of the mitral valve, as though by rubbing against it, and the chordæ tendinæ leading therefrom were thickened and very soft. A smear of this vegetation showed it to be composed almost entirely of Gram-positive diplococci, mostly misshapen and degenerated, and the culture from the vegetation yielded a pure culture of Streptococcus viridans identical with the strain found in the blood-culture made during life. There was a large septic embolism containing streptococci in the left Rolandic area, as well as in the spleen and lungs. The kidneys showed numerous red spots, slightly raised, 2 to 4 mm. in diameter, scattered over the surface and through the cortex. Microscopic section showed the glomeruli to be greatly enlarged with leukocytes, red blood-cells and a few streptococci, and surrounded by a zone of round-cell infiltration.

We will now consider the case to be presented today and postpone our summary of the first case in order to contrast it with the second case.

CASE II

It is worth while paying the strictest attention to the clinical features of this second case. It is surprising how it displays many of the symptoms of the case we have just reviewed and yet in the last analysis falls into a distinctly different clinical group.

This is the case of a young woman twenty-two years old, who had acute rheumatic fever at the age of five and again at seventeen. On several occasions during the past five years, since her last attack of rheumatism, she has experienced difficulty in breathing when doing heavy work, and at such times she has noticed that her feet swelled. About two months ago, during the epidemic of influenza, she became ill, complaining of weakness, of tiring easily, of shortness of breath on exertion, of feeling feverish, and of vague, fleeting sharp pains about her heart. She had several severe attacks of nausea and vomiting. As a matter of fact, she did have a temperature of 102° F. on the several occasions it had been taken during the two months before she presented herself to the out-patient department. Her symptoms and signs at that time clearly spoke of an infection whose focus lay in the heart. She had fever, systolic murmur at the apex transmitted to the axilla, diastolic murmur over the aortic area, and slight edema of the ankles. She was considered to be suffering either from rheumatic endocarditis or bacterial endocarditis, such as the case we have just heard described. In what did the two cases differ? On what grounds were they separated, and placed in different clinical groups? Let us now consider the clinical details in this girl's case as they were revealed after she entered the hospital. The most impressive event that occurred was the development of a typical attack of acute rheumatic fever, polyarthritis—with hot, tender, swollen knees and shoulders filled with the turbid fluid you saw taken from the right knee—and great prostration.

The examination of the heart showed the murmurs above indicated, enlargement, and arhythmia. The electrocardiogram showed an occasional ventricular extrasystole and slightly delayed conduction.

This case was definitely shown to be not a case of bacterial endocarditis by the bacteriologic studies.

The blood-cultures, repeated on three occasions, were sterile. The urine at no time showed any bacteria or blood-cells, and a culture was sterile.

Here, then, we have two cases of endocarditis, one bacterial and the other non-bacterial. The cultures were the determining points. The green color of the skin, while a very significant sign, is not always present. Of course, when embolism has occurred, there should be less confusion in diagnosis. The similarity of the clinical manifestations is valuable in emphasizing the importance of the blood-culture.

The character of the blood-culture in bacterial endocarditis is unique, in that it shows remarkable constancy. If a culture shows 50 or 300 colonies per cubic centimeter one day, it will usually show the same count for weeks. Just before death the bacteriemia becomes intense.

No such cases, where the diagnosis has been surely established, have recovered. To speak of such types of heart infection becoming bacteria free is to assume much. What constitutes the diagnosis?

We might have found a few colonies of green streptococci in the rheumatic case in one blood-culture and then none in subquent cultures. Such a finding must not be considered sufficient evidence for calling the case one of bacterial endocarditis. Before a diagnosis of bacterial endocarditis can be made the bacteriemia must be found to be constant. Most of the confusion rests on this point. It is important to make it clear. The lesions of rheumatic endocarditis are hard, small, verrucose nodules, which are homogeneous and hyaline-like in composition and have no bacteria. The vegetations of bacterial endocarditis are soft and friable and composed almost entirely of bacteria. The heart muscle in rheumatism contains Aschoff bodies. These are not found in bacterial endocarditis without rheumatism. The cause of rheumatism is unknown. It is true the streptococcus is the one organism that has been found associated with such cases, but its causal relationship has never been

proved. We must keep our minds open on this subject. We must remember that the green streptococcus is a common variety in human mouths, and the adjective "viridans" does not refer to a special kind. Once the heart valve is seriously injured by a previous disease, an invasion of the blood-stream by these streptococci from the mouth, incited perhaps by tonsillitis, may result in implantation on the diseased valves.

Endocarditis is most simply classified by dividing the cases into bacterial and non-bacterial types. Of the former we have several varieties, the clinical course of each of which depends on the invading organism. When staphylococci or gonococci invade, the course is short and "malignant," and death occurs usually within a month. When a streptococcus is implanted, the course is "subacute," but death is certain. All bacterial types may ulcerate. Rheumatism produces the type of non-bacterial endocarditis. Attended as it is by fever, we are prone to regard it as bacterial in origin. But we may find a cause for this apparently infectious process other than the streptococcus. Such endocarditis most often proceeds to chronic changes in the heart valves which may last for many years, all the time being bacteria free.

CLINIC OF DR. J. CURTIS LYTER

ST. ANTHONY'S HOSPITAL

THE SUBACUTE AND CHRONIC NON-TUBERCULOUS PULMONARY INFECTIONS

To most every clinician with the opportunity for close and continuous study of disease processes there are presented from time to time diagnostic problems, the solution of which even after the most intense study of the clinical history with the evolution of the various symptoms carefully delineated, and a most carefully conducted physical examination including the various and well-recognized laboratory and roentgenographic examinations, is seemingly not only most difficult but impossible.

Under such trying and perplexing circumstances the clinician should not become unnaturally discouraged, but should, by realizing the intricacies of the problem so presented, be stimulated to greater and greater efforts, until finally the award of truth and intellectual discernment render to him not only a correct solution, but a true mastery of the diagnostic problem.

In no field of diagnosis do more perplexing and intricate problems exist than in that of the pulmonary infections. So varied and complex are the physical phenomena resulting from these infections that well trained indeed must be the clinician who even attempts their full evaluation.

The inability to correctly interpret the physical phenomena associated with pulmonary infections is the result of an indefinite knowledge of the physics of the normal respiratory sounds; and, certainly, where the normal phenomena of an organ are inexplainable, the pathologic variations due to disease must remain practical mysteries.

When once duly awakened to these facts the clinician diverts his study from the pulmonary signs and seeks changes in other organs and tissues that will unfold to him the real character of the pulmonary infection.

For many years it was the practice of the more advanced clinicians to consider every patient exhibiting a cough, fever, and some changes in the respiratory sounds as a case of pulmonary tuberculosis. For this reason even today all chronic lung infections are discussed in terms of tuberculosis; hence we discuss the non-tuberculous infections of the lungs.

The conception of a subacute or chronic pulmonary infection due to pneumococci, streptococci, staphylococci, or the organism of influenza has for its origin the known reactional processes during the acute invasion of the pulmonary tissues by these organisms, and the apparent inability of the tissues in some cases to undergo complete resolution when once the acute process has definitely subsided.

The medical literature of the past years is replete with reports resulting from close and diligent study of these infections by many unprejudiced and careful clinicians. In all of these studies the final conclusion was that the infections do exist in moderate numbers and are frequently recognizable if all of the lung infections are closely studied.

The study here presented consists of 8 cases observed for a definite length of time on the medical service of St. Anthony's Hospital in St. Louis. The study deals especially with the time and character of the onset, the respiratory and general symptoms, the physical signs in the lungs, the *x*-ray findings, the changes in the blood, and the examination of the sputum.

Onset.—In the 8 cases 1 was of fourteen years' duration, 2 were of approximately nine years, 2 approximately six years, and 3 were of three years' duration.

In respect to the duration of the symptoms there is nothing to in any way distinguish these infections from tubercular infections, as tuberculosis is observed not infrequently over a period of ten or twenty years, during which time there are periods of remissions, exacerbations, and stationary periods, conforming in

every feature studied to the clinical course of the non-tuberculous infections.

Each case gave the history of the onset being in the fall, winter, or early spring months. Six of the 8 cases had an onset similar in all respects to that of an acute cold. At its inception the acute infection involved the upper respiratory passages only to spread rapidly to the lower passages. Following this acute infection there developed a subacute or chronic respiratory syndrome affecting the lower passages only. A clinical history delineating an onset of this character is most valuable in excluding pulmonary tuberculosis as the cause of the clinical picture.

During the acute onset the diagnosis may vary from an acute pharyngotracheitis to a marked attack of epidemic influenza. After a partial recovery from the acute symptoms the patient is usually discharged, and may, after a time, consider himself well, retaining a slight and periodic cough as the only vestige of the acute illness. After a variable length of time there appear periodic attacks of general malaise, slight or moderate temperature, cough, and expectoration of a variable quantity of sputum, the character of which is in no way distinctive. This attack may last from two to ten days and be followed only by a cough, which may be either severe or slight.

The only possible way by which pulmonary tuberculosis could simulate this onset and course is in that not altogether rare circumstance wherein a pulmonary tuberculosis, stationary or partially healed, becomes activated by an attack of influenza or a more simple acute respiratory infection. After being thus activated the tuberculous process runs the irregular and intermittent course so common in certain types of individuals. In some cases a careful study of each symptom, especially with regard to its onset and evolution, aids very materially in making the final analysis and ultimate decision as to the diagnosis. For that reason an attempt is here put forth to consider each of the salient symptoms individually.

Cough.—Each of the 8 cases gave a very definite history of a subacute or chronic cough; usually worse during the winter

months, during which time it undergoes many exacerbations and is associated with an expectoration of a large quantity of thick, purulent sputum. The character and study of the sputum is considered in detail elsewhere. The cough itself portrays no features which would enable one to distinguish it from the cough or any respiratory disease, either malignant, circulatory, or infectious. One feature which may be of passing value in excluding pulmonary tuberculosis is the notable absence of any hemorrhagic tendency.

The general symptoms associated with the cough were: loss of weight, either slight or severe, lassitude, capricious appetite, varying degrees of night-sweats, a variable temperature, and more or less exhaustion. These general symptoms are indicative only of a subacute or chronic infection, and are common in both tuberculous and non-tuberculous infections located either in the lungs or elsewhere. Likewise, there is nothing in the development or the evolution of these general symptoms, taken either singly or collectively, to serve as a differential basis between the two types of infection. The afternoon rise in temperature which for decades was taken as strong, and at times almost conclusive, evidence of tuberculosis, is encountered in any chronic infection. The rise during the afternoon and evening does not depend altogether upon the type of infection, but to a great extent upon the physical and mental activities of the individual. During recent years this same afternoon rise in temperature has been discovered in chronic infections of the tonsils, teeth, gall-bladder, and pelvic organs, so that its ultimate value as a sign in tuberculosis depends upon the exclusion of all other chronic infections which at the time may be active.

Physical Signs.—During an acute exacerbation there were usually the physical signs present indicative of pulmonary consolidation: as slight increase in the tactile fremitus, slight or pronounced dulness, increased muscular tone over the lesion, crackling râles, tubular breathing, and egophony. During the chronic stages the physical signs were not distinctive and consisted mostly of a few râles, either localized or scattering, with at times some alteration of the breath sounds. More important

than the kind of physical signs discoverable is the location of the lesion.

The time has passed when any differential etiologic value is granted to any particular sign in the lung, with very few exceptions. No type of râle is characteristic of a tuberculous lesion or any other lesion. A râle is of value only as to whether it is moist or dry, and then it is of pathologic and not etiologic significance. What is true of the râle is equally true of the variations in the respiratory murmur, the transmission of the voice sounds, the percussion phenomena, and the muscle changes. It should be granted, however, that the demonstration of a cavity in the absence of an actinomycotic infection is conclusive evidence of tuberculosis, as cavitation is unknown in the other non-tuberculous infections.

The location of the physical signs is of inestimable value in arriving at a differential diagnosis. The presence of persistent physical signs in the apex of an upper or lower lobe, when taken in conjunction with the general symptoms delineated above, is suggestive, but by no means conclusive evidence of pulmonary tuberculosis. This is the most frequent site of tubercular lesions, and changes are almost constantly found in one of the apices even when the most pronounced findings are elsewhere. Chronic non-tuberculous lesions are also found in the apices, but the great majority of them are found in the dependent portions of the lower lobes. While thus the location of the lesion is by no means pathognomonic, it nevertheless carries with it a great value in the final differential diagnosis.

In 5 of the 8 cases being considered the physical findings were confined to one or both lower lobes; in 1 case they were in the right middle lobe and in 2 cases they were in the left upper lobe. A subacute chronic infection localized in one or both lower lobes should be considered non-tuberculous until it is definitely proved otherwise.

***x*-Ray Findings.**—The *x*-ray findings consisted mostly of mottling, localized diffuse hazziness, or peribronchial infiltration of various grades. There is nothing in the particular character of the roentgenographic findings to serve as a process of

differentiating this from tubercular infection. The location of the lesion as demonstrated by the roentgenogram is of more value than any specific character that may possibly be attributed to the tissue reaction to this infection, in so far as it is possible to demonstrate this change roentgenographically.

Since the more or less perfection of the stereoroentgenogram as a means of examining the lungs, there have been advanced various characteristics of tubercular and other infections. Remembering that all infections within the lung tissue must have their inception and extension through either the lymph-channels or the alveoli, it is quite improbable that tuberculosis or any other infection can so invade either of these avenues in a manner so different from all other infections as to render their differentiation by means of the *x*-ray shadows possible. The only personal satisfaction found in the *x*-ray examination is in confirming the presence of lung changes, their location, and to some extent the extensiveness of the lesion.

Blood Changes.—When a lung lesion has been definitely demonstrated to be present, probably the greatest assistance in determining the character of the infection is rendered by a carefully conducted examination of the blood.

Subacute or chronic pulmonary tuberculosis almost always produces a mild leukopenia with an increase in the percentage of the small lymphocytes, demonstrable upon a carefully conducted differential count. The total white count usually ranges from 5000 to 7000, with a differential count revealing from 30 to 35 per cent. small lymphocytes. An important exception to this rule is found in those cases where a secondary infection complicates the clinical picture. As the secondary infecting organisms are always the pyogenic cocci, the blood-picture is usually one of a mild leukocytosis with a rather sharp increase in the percentage of the polymorphonuclears. Where this condition prevails there are usually tubercle bacilli in the sputum to clear the diagnostic field. The non-tuberculous infections reveal in the subacute stage a rather high leukocyte count. In one of this series the count would reach 18,000 during an acute exacerbation, only to fall to 10,000 or 11,000 following the ex-

acerbation, and there it would remain. The polymorphonuclear percentage in this case varied from 78 to 88 per cent., depending upon the activity of the process.

Even the chronic types of the infection most generally will reveal an increase in the percentage of polymorphonuclears if the differential count is accurately conducted. In this series of 8 cases, 4 cases which were essentially chronic, in that they did not demonstrate a tendency to acute exacerbations, revealed a leukocyte count varying from 9000 to 11,600, and a polymorphonuclear percentage varying from 76 to 82 per cent. In none of the 8 cases was there a leukocyte picture falling within what is usually considered normal limits. While probably there is no extreme disorganization of the leukocyte picture, there is always a marked and persistent departure from the normal, and when thus repeatedly demonstrated is very, very valuable in making a final analysis of the clinical picture.

In the 8 cases being considered the percentage of polymorphonuclears was between 75 and 80 per cent. in 4 cases and between 80 and 85 per cent. in 4 cases.

Sputum.—There was a time when an examination of the sputum for tubercle bacilli was the only examination conducted by the hospital or private laboratories. During these times the failure to discover tubercle bacilli in the sputum, regardless of how copious the sputum or what its character, did not mitigate in any way a diagnosis of pulmonary tuberculosis. Today this feeling has changed until the absence of tubercle bacilli from a profuse, thick, and purulent sputum renders a diagnosis of tuberculosis not only difficult, but extremely doubtful.

Before the age of the laboratory achievements the clinician attached great importance to the physical characteristics of sputum, and many classical phrases can be found in the old literature describing the physical characters of sputum of the various lung diseases as they were at that time recognized. These descriptions depict to me men of keen and accurate clinical observation as well as men who were accustomed to the most intense clinical analysis. To men of this type, notable among whom was the great Trousseau, and later his student

Dieulafoy, we owe for the physical description of the sputum of pulmonary tuberculosis, lobar pneumonia, bronchiectasis, and pulmonary embolism.

With the advent of the present laboratory methods the study of sputum became not only simplified, but very accurate, until today no sputum examination is considered at all complete until the stain for tubercle bacilli has been supplemented by Gram's stain, Smith's stain, a culture, and, as a general rule, a guinea-pig inoculation.

Likewise no sputum is considered free from tubercle bacilli unless a large number of slides from daily specimens of sputum have been examined by a competent technician.

Where the sputum is copious, yellow, tenacious, free from tubercle bacilli, and contains a great preponderance of some other organisms, usually the pneumococcus or streptococcus, the evidence is very strongly against tuberculosis and greatly in favor of a non-tuberculous infection.

In the 8 cases being considered the sputum, which was always profuse and purulent, contained no tubercle bacilli. The predominating organisms in 5 cases, as shown by both the differential stain and culture, was the pneumococcus; in 2 a streptococcus, and in 1 the influenzal organism was apparently present in such numbers that it was considered responsible for the lung changes.

Tuberculin Tests.—The von Pirquet, Calmette, and Moro tests for tuberculosis have finally become recognized as worthless, so no reference will be made as to their clinical value other than to maintain their worthlessness. I do not feel, however, that this should also be applied to the subcutaneous injection of tuberculin for diagnostic purposes. The absence of any general or focal reaction after an injection of 2 or 5 milligrams of old tuberculin is noteworthy toward excluding an active tuberculous lesion. The appearance of a reaction is in nowise conclusive evidence of an active tuberculosis. The subcutaneous injection of tuberculin, then, should be considered of only negative value. Many arguments have been advanced against the diagnostic use of tuberculin; the most persistent one being that

possible harm may result to the patient by activating a quiescent process. Like most other diagnostic measures, tuberculin has its dangers, especially in the hands of the untrained or the careless. This same criticism can apply to the *x*-ray, lumbar puncture, or exploratory laporatomy, still we would not consider for one moment surrendering these valuable diagnostic aids simply because careful training is necessary to render them practically harmless. Tuberculin directed by a brain capable of knowing when and how it should be used is a most valuable aid in excluding tuberculosis.

Finally, I wish to leave the impression that the non-tubercular infections of the lungs can be recognized if in every lung case the history, physical and roentgenographic examinations, and the blood and sputum examinations are carefully conducted, and, finally, if the patient is being studied by a brain that has been taught to think and is inherently analytic and not given to blindly following some systematic routine.

CLINIC OF DR. LOUIS HENRY HEMPELMANN

EVANGELICAL DEACONESS HOSPITAL

PAGET'S DISEASE OF THE BONES (OSTEITIS DEFORMANS)

Etiology, Pathology, Differential Diagnosis, Prognosis, Probable Endocrine Origin

THE first case I wish to present is a typical case of Paget's osteitis deformans—in fact, so typical that the diagnosis can be made at a glance. Before calling in the patient I think it would be well to read extracts from Paget's description of the disease. This description was written by the eminent London physician, Sir James Paget, in 1876, at which time he presented 5 cases of this disease before the London Medical Chirurgical Society; it is so clear and concise that I feel it could not have been improved upon:

"It (osteitis deformans) begins in middle age or later, is very slow in progress, may continue for many years without influence on the general health, and may give no other troubles than those which are due to the change of shape, size, and direction of the diseased bones. Even when the skull is largely thickened, and all its bones exceedingly altered in structure, the mind remains unaffected.

"The disease affects most frequently the long bones of the lower extremities and the skull, and is usually symmetrical. The bones enlarge and soften, and those bearing weight yield and become unnaturally curved and misshapen. The spine, whether by yielding to the weight of the overgrown skull, or by change in its own structure, may sink and seem to shorten with greatly increased dorsal and lumbar curves; the pelvis may become wide;

the necks of the femora may become nearly horizontal, but the limbs, however misshapen, remain strong and fit to support the trunk. In its earlier periods, and sometimes throughout all its course, the disease is attended with pains in the affected bones, pains widely various in severity and variously described as rheumatic, gouty, or neuralgic, not especially nocturnal or periodical. It is not attended with fever—no characteristic condition of urine or feces have been found in it. It is not associated with syphilis or any other known constituent disease unless it be cancer. . . .

"In all cases I have seen the general appearance, postures, and the movements of the patients have been so alike that these alone might suffice for the diagnosis of the disease. The most characteristic are the loss of height, indicated by the low position of the hands when the arms are hanging down, the low stooping with very round shoulders and the head far forward and with the chin raised, as if to clear the upper edge of the sternum, the chest sunken toward the pelvis, the abdomen pendulous, the curved limbs held apart and usually with one advanced in front of the other, and both with knees slightly bent; the ankles overhung by the legs and the toes turned out. The enlarged cranium, square looking or bossed, may add distinctiveness to these characters, and they are completed in the slow and awkward gait of the patients and in the shallow costal breathing compensated by wide movements of the diaphragm and abdominal wall, and in deep breathing by the uplifted shoulders."

Bearing this in mind, I would now like to present Mr. S., fifty-nine years of age, who came under observation in May, 1919. His family history is negative. He has always enjoyed good health, and he says that he has never at any time suffered from rheumatic pains. He has been a hard drinker in his younger days and contracted lues when about twenty-five years of age. Two years ago he underwent a prostatectomy. His general appearance is so striking as to bring back almost at once Paget's description of osteitis deformans. He says that he has been growing shorter for about ten years. Originally he was 5 feet, 8 or 9 inches tall, at present his height is only 5 feet, $2\frac{1}{4}$ inches.

The height has decreased 1¼ inches in the past eighteen months since under our observation. His head is quite enormous, 63¾ cm. in circumference, and has been enlarging for ten to twelve years. Formerly he wore a No. 7 hat, now a No. 7½ is rather small for him. His lower jaw has enlarged so that now the lower teeth articulate ½ inch in front of the upper, while formerly the upper teeth articulated in front of the lower (prognathism). There is no separation of the teeth, as in acromegaly. The left side of the lower jaw is rather more thickened than the right—the head rests almost on the sternum, which shows an exaggerated anterior curve. The spine is markedly kyphotic, the anteroposterior diameter of the chest is greatly increased, the abdomen is rather short and pendulous, and the hips somewhat flaring. The knees are bowed so that they are separated at least 3 inches (formerly the legs were quite straight), the femora are bent anteriorly and laterally, and the patient's gait is somewhat waddling. The arms appear rather long and the hands and fingers do not at all suggest an acromegaly. The *x*-ray shows great irregular mottled thickening of the outer table of the skull and greatly thickened compact bone in the shafts of the tibiæ and femora.

The second case was discovered quite by accident. This lady is forty-nine years of age, a widow, who came under observation about a year ago on account of a convulsive tic of the left side of the face of three years' duration. The family history was unimportant, and she claimed to have enjoyed good health up to the onset of the spasm. She had never had any headache, vertigo, or rheumatic pains.

The physical examination shows a rather stout woman, 5 feet, 1½ inches tall, who has a rather broad face. The head seems rather large, but is not sufficiently enlarged to attract attention; circumference of the head is 62½ cm. The outline of the head is somewhat irregular, but this also is not striking. The thoracic and abdominal viscera are quite normal and the chest is not at all deformed and the legs are quite straight. The general neurologic examination is negative and the eye-grounds and fields of vision are normal. The urinalysis is negative and the blood Wassermann is negative.

In looking for a possible cause for the tic it was thought wise to obtain a head picture to see whether the sinuses were in good condition. This *x*-ray of the head shows a great irregular mottled thickening of the outer table of the skull almost exactly similar to the one of the other case.

A close investigation of the other bones of the skeleton, including *x*-ray of the tibiæ and femora, shows nothing abnormal. This is evidently a case of Paget's disease limited to the skull. The only other disease with which it might be confused would be a leontiasis ossea, after Virchow, but the late onset and *x*-ray picture would speak against this diagnosis. I do not believe that the Paget's is in any way responsible for the tic.

Sir James Paget called this disease osteitis deformans, but usually it is known as "Paget's disease of the bones." It is rather rare, some 200 cases having been described by various authors. In many cases the disease is limited to one bone or to one extremity—often the head alone is affected, as in the second case.

The disease undoubtedly existed in ancient times; examples of it have been found in the Indian mounds in this country, while Jonathan Hutchinson (Illustrated Med. News, 1889) claimed that a skull taken from an Egyptian tomb showed evidence of Paget's disease. Formerly these cases were classed with other osteopathies as examples of adult rickets, osteomalacia, etc., but Paget's disease is so clear cut and a fully developed case so characteristic that it is easily separated from the rest of this group.

The **etiology** is quite obscure. While occasional cases have been reported in which several members of a family were afflicted with it, the number is too small to warrant any conclusion as to any familial influence in its causation. Certain French writers (Fournier and Lannelongue) contend that Paget's disease is nothing more than a late manifestation of hereditary syphilis, although Kienbock and others assert that it is possible to differentiate it from syphilis by means of the *x*-ray. Paget himself asserted positively that the disease had nothing to do with lues, and his view has been accepted by most authors.

The latest and probably most acceptable theory is that the

disease is due to faulty internal secretions. The influence of the parathyroids in calcium metabolism is generally known, while the relation between the anterior part of the pituitary gland and bone growth is generally accepted. The autopsy reports are too few to warrant general conclusions. Bartlett, however (Yale Med. and Surg. Jour., 1910), reports a case with definite increase in the chromophil cells of the anterior part of the pituitary gland, and Higbee and Ellis (Jour. Med. Research, 1911) report one of disease of the parathyroids in a case of Paget's disease.

For the present it would seem that we really know but little more of the etiology of osteitis deformans than when Paget first described it, although the endocrine theory seems very plausible.

Pathology.—The initial process seems to be a rarefying osteitis which results in resorption of bone. Later there is a production of a poorly calcified new bone which is soft and yielding. The bones bend wherever they are exposed to strain, which causes the deformities so characteristic of the disease. Later they become abnormally hard and thickened, so that after years they may be as hard as ivory.

The skull and long bones of the legs are most frequently affected, although the bones of the spine are often involved. The skull is greatly increased in thickness, but as the deposit does not encroach on the cavity of the head and is entirely on the outer table, the mentality remains unimpaired. In passing it may be remarked that at no time is there any abnormal tendency to fractures present differing in this regard from fragilitas osseum. The *x*-ray shows an irregular mottled thickening of the skull and a great increase of the compact part of the long bones involved which is said to be characteristic of this disease. It is difficult to obtain good *x*-ray pictures of the skull, as the softened condition of the bone allows the rays to penetrate too easily to give good contrasts.

Differential Diagnosis.—A fully developed case is so characteristic that the diagnosis can be made at a glance. Osteomalacia and carcinomatosis may cause difficulties, although the *x*-ray would help to make the differentiation. When confined to one bone a luetic periostitis may have to be considered.

Prognosis.—The disease is slowly progressive as a rule, but probably only indirectly shortens life.

Now a word in regard to the treatment of these cases. In view of their probable endocrine origin it would seem as if some attempt at treatment by means of organotherapy (anterior pituitary and perhaps parathyroid) would seem indicated.

CLINIC OF DR. ELSWORTH S. SMITH

BARNES' HOSPITAL

CARDIOLYSIS FOR CHRONIC MEDIASTINOPERICARDITIS, WITH REPORT OF 2 CASES AND REVIEW OF LITERATURE TO DATE.*

WE present today a case of chronic mediastinopericarditis with the report of another case and a brief review of the literature to date.

This patient, our second case, is A. T. D., a female[1] thirty-eight years old, who came under our observation first in 1898 in consultation with Drs. McCandless and Neuhoff, at St. Mary's Infirmary. She was then in an extreme condition of cardiac decompensation from mitral insufficiency resulting from polyarticular rheumatism starting one year before. All the usual remedies had been tried without result. We were at that time interested in the introduction into this city of the artificially prepared Nauheim baths, and the above-named physicians desired to have these tried in their case. Notwithstanding the patient was almost moribund, we started her on a Nauheim course, not, however, promising any results, and were astounded at the good effect of the treatment from the start, for after the first few baths she obtained refreshing sleep which she had not enjoyed in weeks, and, in a word, after twenty-two baths given every other day her extensive general anasarca had vanished and

* A clinical lecture delivered before the Senior Class of the Washington University Medical School, in Barnes' Hospital, May 27, 1920. The author desires to acknowledge his indebtedness to Dr. George Dock for many valuable suggestions, to Drs. H. H. Shackelford and Herman Schussler, Jr., for kindly help in the report of the cases, also to Drs. E. C. Ernst and Sherwood Moore for valuable aid in the *x*-ray studies of the cases, and to Barnes' and St. Luke's Hospitals for their generous co-operation in the observation of the patients.

her cardiac compensation had been so completely restored that she has been able to work steadily at her trade in a book bindery for fifteen years until the onset of her present trouble.

She reported her continued good health for a time after leaving St. Mary's Infirmary, but soon was not heard of any longer, and was not seen again until shortly after February 20, 1919, when, while making my ward round at Barnes' Hospital, I came to her bed, when she was found presenting an entirely new symptom-complex, for instead of being then generally waterlogged, as she was in 1898, she manifested an extensive ascites without practically any edema of the lower extremities—an utterly different problem than the one encountered in the first illness.

Her present trouble dates back to March 23, 1913, when, while walking fast to reach home on a very windy day, she was suddenly seized with such severe dyspnea as to make it necessary for her to stop several times on the way to get her breath, and was unable to sleep lying down during the following nights. She was able, however, to return to work in a few days, but was again forced to stop work the following July, and her disability has been constant since then. In January, 1914 her abdomen began to swell, without any edema of feet, and required paracentesis in July, 1914, when 3 gallons of fluid were removed in two sittings. Since then, up to date, she has been tapped about twenty times, and the last two years has required this operation at intervals of every five or six weeks. Ever since the onset of present trouble, until within the last few weeks, she has required being propped up in a sitting position in bed in order to obtain sleep. In May, 1918 a modified Talma operation was made, based on a diagnosis of hepatic cirrhosis, but without any benefit, and her physician, Dr. C. A. Wood, of St. Joseph, Mo., who was present at the operation, in a letter to Dr. Dock stated that "the peritoneum was perfectly smooth, no evidence of tuberculosis, no fibrosis of capsules of liver or spleen, both these organs looking, in fact, as normal as he had ever seen them."

As to her previous history, besides the attack of rheumatic fever in 1897, she had measles in childhood and an attack of intermittent fever at ten years of age. No tonsillitis or chorea.

Her family history disclosed the death of her father at sixty years with dropsy and Bright's disease. Mother living, but the victim of bronchial asthma; three brothers living and well, one brother died in infancy. Six sisters, 4 died early, 2 died at two years. No tuberculosis or definite history of lues.

Menstruation started at seventeen years, always irregular, at times only appearing once a year. No pain. Habits: Never used alcohol or condiments. In our study of her here February, 1919, at Barnes' Hospital the following conditions were determined: Apparently a well-nourished woman. Abdomen greatly distended with fluid. Lips and nails slightly cyanotic. Dyspneic even at rest; forced to be propped up in bed in sitting position. Apex-beat diffuse and wavy.

Outline of cardiac dulness:

Right.	Left.
2.5 cm., third I. C. S.	4.0 cm.
3.0 cm., fourth I. C. S.	7.5 cm.
4.5 cm., fifth I. C. S.	14.5 cm.

Systolic mitral murmur conveyed into axilla. Presystolic rumble over mitral area. Systolic retraction over apex (determined by myself and Dr. Gilliland). Cardiac dulness fixed, not changing with position of patient (observed by myself), also undulatory retraction in ninth left intercostal space on line of angle of scapula; and suspicion of retraction at tenth intercostal space same area. After tapping and removal of 6350 c.c. of peritoneal fluid lower border of liver was distinctly palpable, firm, but not nodular. Urine showed trace of albumin and a few casts. Blood: red cells, 4,240,000; white, 7800. No fever. Hemoglobin, 80 per cent. Lymphocytes, 24 per cent.; polymorphonuclear, 76 per cent. Wassermann negative to all antigens. Complement fixation for tuberculosis negative. Blood-pressure ran about systolic 130, diastolic 90. Largest pulse deficit was 28. This deficit was practically controlled by 10 c.c. of digitalis given April 21, 1919. Inoculation of guinea-pig with ascitic fluid failed to show presence of tuberculosis. Electrocardiogram showed auricular fibrillation (Figs. 79, 80). Fluoroscopic study disclosed no evidence of pericardial adhesions. Diagnosis: A repetition

of her first attack of cardiac decompensation from valvular disease could be excluded from the presence of ascites, with an absence of general anasarca. Peritoneal tuberculosis could also be excluded, first, on the finding of the peritoneum normal at the time of the making of the Talma operation; second, on the absence of fever and emaciation; third, the long course of the disease. Laennec's cirrhosis of liver, first by the absence of any etiologic factors, as alcohol, use of strong condiments, etc. Second, by the absence of progressive loss of weight and strength during a period of six years.

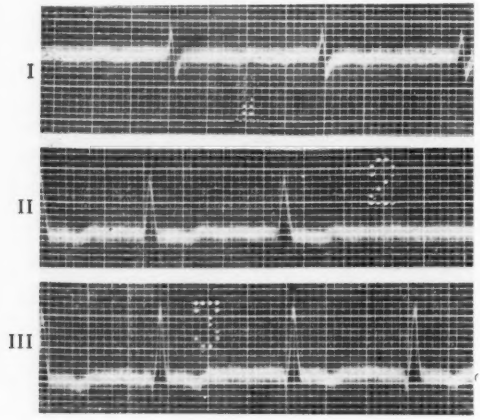

Fig. 79.—Case II. April 23, 1919. Before cardiolysis. After 10 c.c. of digitalis. Shows auricular fibrillation. T-wave inverted in II and III.

Cirrhosis due to chronic hepatic stasis I believe is not generally recognized by pathologists, so that by exclusion the diagnosis had to be chronic mediastinopericarditis. But, inasmuch as the *x*-ray findings were negative and the physical signs not entirely typical, we did not feel justified in operating, so patient returned to her home.

Later she reported her condition as gradually growing worse, so she again came for treatment, going this time to St. Luke's Hospital December 6, 1919, where we were not only able to confirm our former findings, but even fortunate enough to obtain

fluoroscopically definite evidence of adherent pericardium, in our being able to see distinctly a tugging upward of the diaphragm with each cardiac systole.*

Roentgenologic Findings (December 19, 1919).—The fluoroscopic examination of the chest shows evidence of an increase in the heart shadow both toward the right and left margins, more pronounced toward the right side. The general cardiac enlargement is irregular and very suggestive of pericarditis with effusion.

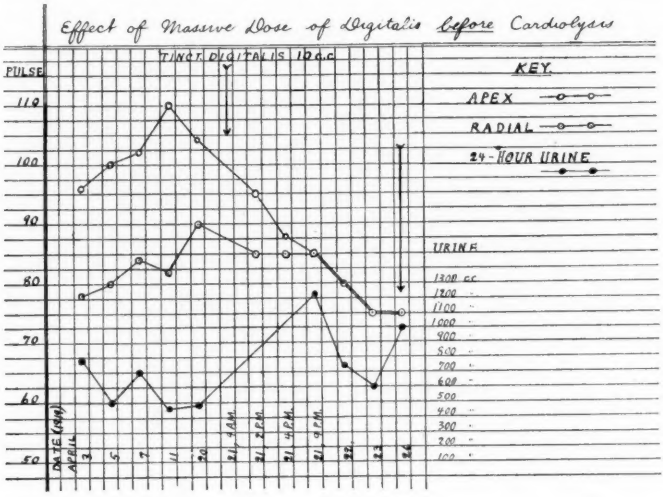

Fig. 80.

However, further observations do not reveal the usual characteristics of fluid within the pericardium. The cardiac pulsations could be clearly observed, and the position of the heart was unusually high in the chest cavity. It was very apparent, during deep inspiration, that the left diaphragm was more or less fixed toward the apical shadow of the heart, being pulled upward or tugged in synchronism with each heart throb. These observations were observed to be more pronounced following rotation

* We have not met with any allusion to this sign of systolic tugging on the diaphragm in the literature.

of the patient in the semi-oblique position, while the apex shadow was in close proximity to the fluoroscopic screen. This (tugging)

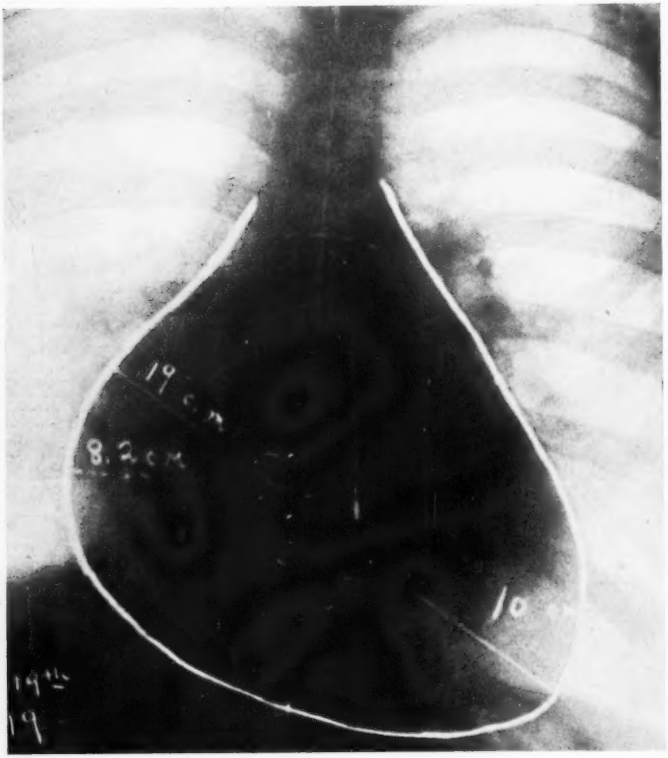

Fig. 81.—Case II. Taken Dec. 19, 1919. Pre-operative radiogram. Note the high position of the heart shadow, and the general cardiac enlargement toward both the right and left side. Oblique diameter of the heart shadow measures 19 cm. Left ventricle shadow 10 cm. Right auricular margin 8.2 cm. Total transverse diameter 18.2 cm. Target plate distance 1 meter. Left cardiodiaphragmatic tug was distinctly observed under the fluoroscope in the region of the left diaphragm.

was accentuated during deep inspiration, forcibly pulling the left diaphragm for a distance of at least 3 cm. with each pulsation of the heart. Further observations along the heart margins did

not reveal similar fixations with the exception of the area along the left superior ventricle border of the heart. However, the fixation was not very marked, and not nearly so graphic as those observed in the apical region of the heart. The posterior mediastinal space density was definitely increased.

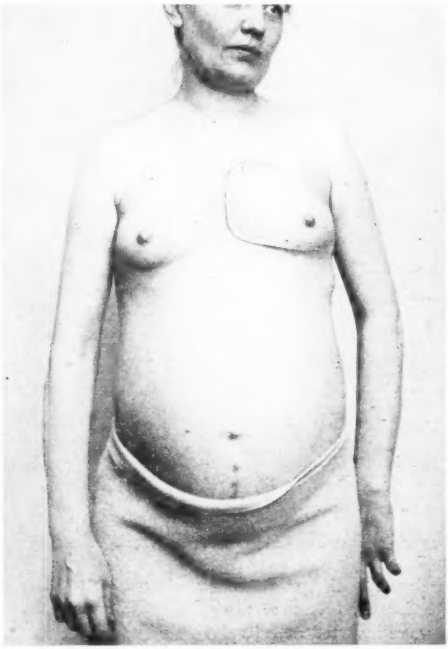

Fig. 82.—Case II, showing incision in cardiolysis. Operation and abdominal distention with, however, good general nutrition, which latter condition could hardly be present if ascites were due to any other cause than chronic mediastinopericarditis.

The radiographic observations corroborated the above findings, with the exception of the fluoroscopically observed left cardiodiaphragmatic tug. The actual fixation could not be visualized upon the radiographic plate.

We were further able to exclude tuberculous peritonitis through a negative inoculation of the peritoneal fluid into the

guinea-pig. Operation was therefore at once advised, which was done by Dr. H. G. Mudd, January 21, 1920, with local block anesthesia, without the least shock or pain. A resection was made of the third, fourth, and fifth left ribs and cartilages from their sternal articulations to slightly beyond the limits of cardiac pulsation to the left of the sternum. As soon as the rigid bony wall over the cardiac area was removed, a distinct and extensive pulling in of the soft parts with each systole of the heart could be seen, showing what difficulty the organ must have encountered

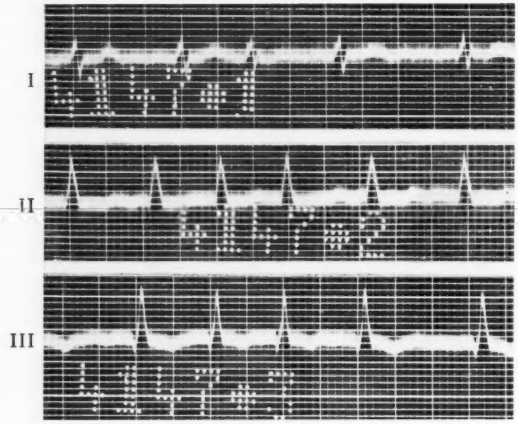

Fig. 83.—Case II. May 26, 1920. Four and one-half months after cardiolysis. Before massive dose of digitalis. Shows auricular fibrillation, rate 150. T-wave inverted in III only.

before the operation in attempting a complete systolic contraction.

Patient was returned to bed in excellent condition, but unfortunately soon developed what was undoubtedly an influenzal pneumonia, which she, however, weathered well, temperature coming to normal and convalescence setting in January 29, 1920. Since this latter date her improvement has been remarkable, she herself stating that she feels like another woman. She can now lie flat in bed and sleep all night—something she has been unable to do since the onset of her present trouble. She has now

no dyspnea while at rest, is sitting up in chair daily for between one and two hours, and she had gone over eight weeks before last tapping, and with less discomfort than for several months, and since her last tapping, a little over one week ago, the circumference of her abdomen had reduced ½ inch. Her phthalein has risen from 38 per cent. for two hours (Figs. 83, 84) December 6, 1919, to 52.8 per cent. on March 20, 1920.

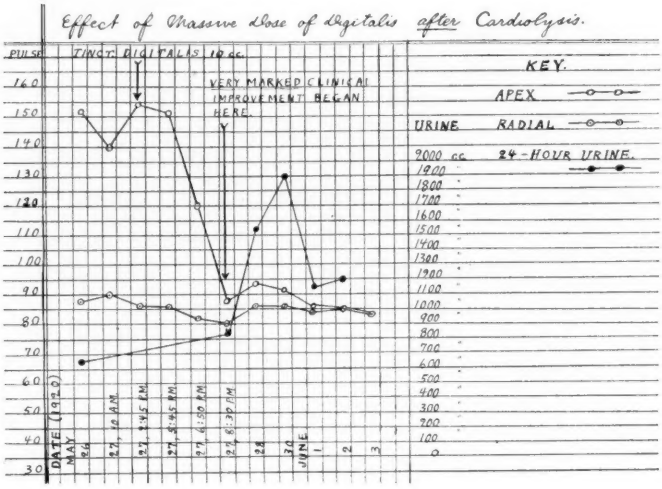

Fig. 84.

Such was her condition when presented at the clinic on May 27, 1920. A study of her record to date develops the following points of interest:

Paracentesis record.		Abdominal measurement record.	
December 30, 1919,	4750 c.c.	March 14, 1920,	36 inches
January 10, 1920,	2500 "	April 24, 1920,	38 "
Operation January 16, 1920		May 14, 1920,	39 "
March 6, 1920,	5250 c.c.	June 28, 1920,	37 "
April 11, 1920,	6350 "	July 14, 1920,	38½ "
April 30, 1920,	6500 "	August 17, 1920,	36½ "
July 7, 1920,	2160 "	October 12, 1920,	34½ "
		October 23, 1920,	34½ "

So that while for a period of two years antedating cardiolysis she had required tapping every five weeks, she has now gone over twelve weeks without paracentesis, and her abdominal measurement has reduced from 39 inches on May 14th to 34½ inches on October 23, 1920.

The behavior also of her heart toward a massive dose of digitalis before and after cardiolysis as shown in the diuresis charts is also of great interest; for before operation the digitalis effect

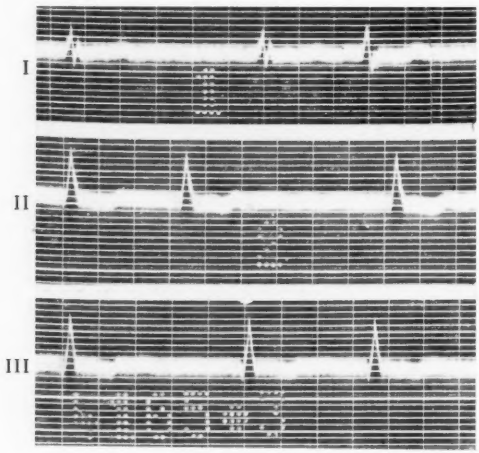

Fig. 85.—Case II. June 3, 1920. Five months after cardiolysis. When 10 c.c. of digitalis had helped to restore compensation. Shows auricular fibrillation, rate 80. T-wave inverted in II and III (digitalis effect).

can be shown only in removal of a small pulse deficit and a slight slowing of apex-rate, and with but slight diuresis, while after operation we not only have a slowing of pulse and obliteration of pulse deficit but also a definitely marked diuresis. The effect of digitalis before operation was, therefore, just sufficient, through influence on vagus, to prevent a great number of impulses from getting through the His bundle, thus enabling the ventricle to rest, and thereby to send more ventricular waves through to the wrist, and yet these ventricular contractions were only sufficiently

strong to slow the rate and remove the pulse deficit, but not sufficiently forcible to originate effective systoles from the standpoint of re-establishing the compensation until the heart muscles were relieved of their handicap by the operation of cardiolysis (Figs. 85, 86). As is shown in the *x*-ray plates, the heart has, since operation, assumed a position lower in the chest cavity and all the dimensions of the organ have been reduced, speaking for its having been loosened from its attachments and thereby permitted to accomplish more perfect contractions, resulting in the reduction of the dilatation.

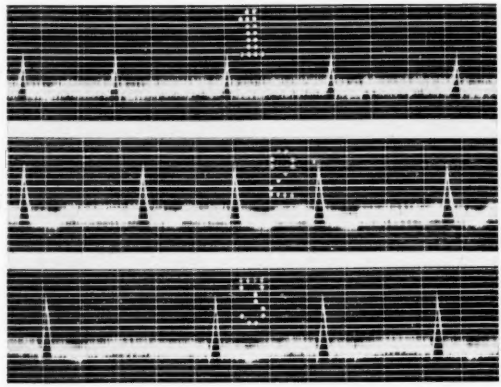

Fig. 86.—Case II. Sept. 26, 1920. Eight months after cardiolysis. Well compensated. Taking digitalis regularly. Shows auricular fibrillation, rate 110. T-wave inverted in all leads (digitalis effect).

Roentgenologic Findings (March 20, 1920).—The fluoroscopic examination of the cardiac shadow following the cardiolysis operation does not show evidence of the previously observed left cardiodiaphragmatic tug.

The radiographic examination shows evidence of a slight decrease of the size of the heart, and a rotation downward of the right auricle upon the axis of the apex of the heart. The oblique diameter of the heart is decreased to 18.2 cm. and the transverse diameter to 17.8 cm.

Roentgenologic Findings (October 11, 1920).—The fluoroscopic

observations are similar to those observed in the previous examination reported March 20, 1920. There was no evidence of the

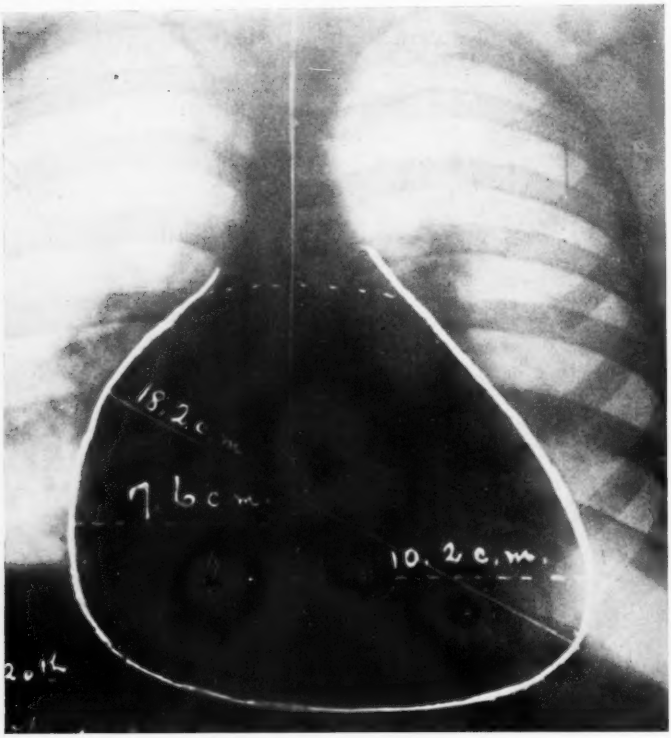

Fig 87.—Case II. Taken March 20, 1920. Postoperative radiogram: two months following cardiolysis operation. Same case as Fig. 79. Note that the right cardiac shadow is lower than the heart shadow in Fig. 81. The right heart shadow is rotated downward upon the apical cardiac axis. The oblique diameter is likewise decreased to 17.8 cm. The transverse diameter is likewise decreased to 17.8 cm. Fluoroscopic examination did not show evidence of the previously observed cardiodiaphragmatic tug. Target plate distance 1 meter.

left cardiodiaphragmatic tug. The heart shadows, both in the oblique and transverse diameters, were further decreased in size.

The radiographic observations corroborate the above findings, the transverse diameter of the heart being decreased to 17.6 cm. and a transverse diameter to 16.8 cm.

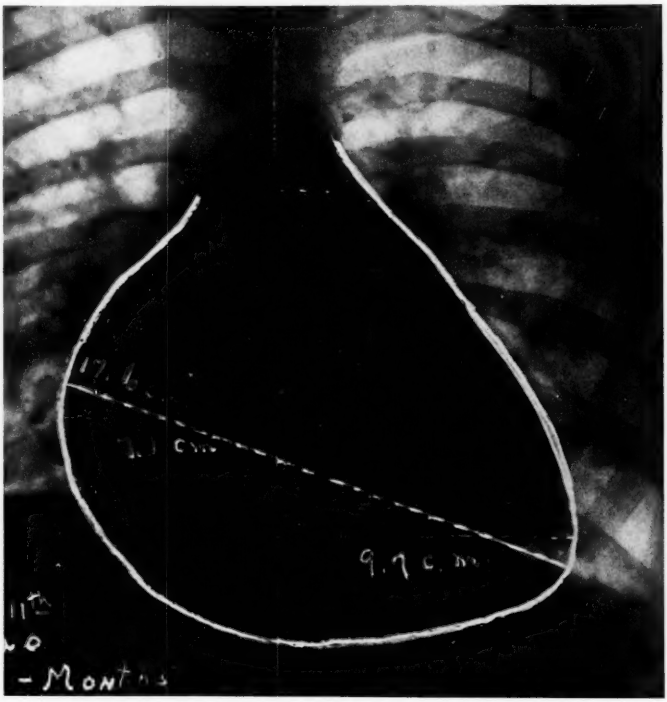

Fig. 88.—Case II. Taken Oct. 11, 1920. Postoperative nine months following cardiolysis operation. Same case as Figs. 81, 87. Note the decrease in the transverse diameter of the heart to 17.6 cm. and the transverse diameter to 16. 8 cm. There is likewise evidence of a further increase in the rotation of the right side of the heart inferiorly. The cardiodiaphragmatic tug continued to be absent fluoroscopically. Target plate distance 1 meter.

As to her general condition, she can now walk about the grounds of the hospital without dyspnea, can also sleep perfectly comfortably lying flat on her back, and feels, in fact, quite well,

her limitation being only excessive physical efforts, so that she is being kept at the hospital solely to prevent a relapse through some careless unreasonable efforts, until such time as her recovery may prove to be more thoroughly confirmed.

Chronic inflammation in and about the pericardium may result, first, in adhesions between the two layers of the membrane, causing obliteration, more or less complete, of the pericardial sac. Second, adhesions may develop between the pericardium and the surrounding organs and structures as follows: First, chondropericardial, fixing the heart to the costal cartilages, sternum, and ribs in front; second, pleuropericardial, gluing the membrane to the pleura and fixing the edges of the lung; third, mediastinopericardial, fixing the posterior surface and especially harnessing the auricles; fourth, phrenopericardial, or fixation to the diaphragm.

When the adhesions involve the left ventricle the disturbance in circulation is mainly at first in the pulmonary or lesser circuit, resulting in dyspnea, asthmatic symptoms, pulmonary edema. While with involvement mainly of the right ventricle we have the stasis going back directly into the great veins, with engorgement of the liver, ascites, and later in extreme cases edema of lower extremities from pressure of ascitic fluid on iliac veins. This engorgement is generally limited mainly to the portal system, giving us the clinical picture of Pick's[2] pseudocirrhosis of the liver, with its insidious onset, ascites rapidly recurring after puncture, intermissions and remissions, with finally signs of involvement of the pericardium. Pick discovered the pericarditic element in his first 2 cases only at autopsy, but was able to diagnose correctly his third patient during life.

In explanation of ascites occurring without edema of lower extremities in this class of cases we quote from Rolleston[3]: "The pericardial adhesions by contracting lead to dilatation of the right auricle, inferior vena cava, and hepatic veins, and by this means free regurgitation of blood into the liver is rendered permanent. It is possible that at the time of the primary pericarditis inflammation spreads to the mouth of the hepatic veins and by weakening their walls leads to dilatation, and so to a freer entry of

blood into them. When once brought about this dilatation of the hepatic veins becomes permanent. The brunt of backward pressure thus falls on the liver, while the other branches of the inferior vena cava, the renal and iliac veins, suffer less than in ordinary cases of chronic engorgement of cardiac origin." Rolleston further states that even when the portal fissure is invaded by the perihepatitis the portal vein hardly ever becomes compressed, as might be expected, and Hale White[4] claims that if the portal veins were compressed or kinked the bile-duct would also be affected, and that this latter result must be very rare from the clinical absence of jaundice.

On the other hand, the clinical picture may partake more of a chronic inflammation of the serous membranes, with effusion into the pleural cavities, and ascites without definite liver findings, affording the picture of chronic serositis or Concato's disease. We, therefore, have clinically two types: First, Pick's disease, where the dropsy is limited at first to the peritoneal sac, the edema in the lower extremities following secondarily as a result of pressure of ascitic fluid on the iliac veins; second, the polyserositis resulting from an extensive chronic inflammation of the serous membranes with chronic hepatitis (ice liver of Curshmann) and chronic perisplenitis. With type two we, of course, are not concerned, as the operation of cardiolysis can do nothing for such cases.

Hutenal in 1895 described a form of liver cirrhosis of cardiac origin.

Fredel Pick (1896) in Pribram's clinic called attention to cases running the course of primary hepatic cirrhosis with ascites, hepatic enlargement, slight jaundice, general weakness, and dyspnea, occasionally enlargement of superficial abdominal veins and edema of feet, but devoid of any special cardiac features, so that discovery of adherent pericardium in his first 2 cases came as a surprise. The livers in these cases showed both interlobular cirrhosis and chronic perihepatitis (ice liver of Curshmann), the peritoneum was thickened, and chronic perisplenitis was present. Flesch and Schossberger[5] were able to reproduce the condition in dogs experimentally. Their work has been confirmed by

Hess, O.,[6] who has also produced cyanosis and cirrhosis of the liver by suturing the inferior vena cava to the diaphragm.

Dunn and Summers state that with this syndrome we have a chronic stasis of the liver and portal system and formation of an indurated (cirrhotic) nutmeg liver.

Quoting Rolleston again: "The liver (in pericarditic pseudo-cirrhosis of the liver) shows marked chronic venous engorgement with very irregularly scattered islands of fibrosis. Much of this apparent increase in the amount of fibrous tissue is due to atrophy of the liver cells, allowing the existing fibrous tissue to come into prominence. There is perhaps a little active proliferation or fibrous hyperplasia, and by careful selection areas resembling multilobular cirrhosis with addition of chronic venous engorgement can be found in microscopic sections. Taken, however, as a whole, the amount of fibrosis is scanty and may be absent in considerable areas. Under the capsule there is extensive atrophy of the liver cells and fibrous replacement. If microscopic examination was limited to a section from this part of the liver there would appear to be extremely marked fibrosis, but the extent of the fibrous change is limited to a small area under the capsule. It is, however, enough to produce very definite opacity and, as has been already pointed out, imitates chronic universal perihepatitis. The two conditions are, however, entirely different; for in chronic universal perihepatitis (iced liver) the fibrosis is on the outer surface of the capsule. The liver thus shows the changes of chronic venous engorgement with rather more sporadic fibrosis than is usually present in simple hepatic stasis, but there is no tendency to compression or narrowing of the branches of the portal vein as in genuine portal cirrhosis. Although there is, as a rule, no genuine cirrhosis comparable to portal cirrhosis in cases of ordinary adherent pericardium, it appears from Diemar's[7] and Wells'[8] figures that when calcification occurs in an adherent pericardium well-marked hepatic cirrhosis is found in the great majority of cases. What relationship, if any, exists between calcified pericardium and hepatic cirrhosis is unknown." Rolleston is thus quoted at length in an effort to clear up in a way the hotly contested question as to whether or not true hepatic cir-

rhosis results from chronic mediastinopericarditis, for should the ascites be due in this disease to genuine cirrhosis of the liver, then the operation of cardiolysis would be powerless to afford any relief.

As to the etiology of chronic adhesive pericarditis, the condition naturally results from acute and chronic pericarditis, and, therefore, the longer the course of a pericarditis, the more apt are adhesions to result. Hence the great importance from a prophylactic standpoint of making every effort to control pericarditis as quickly as possible.

In regard to the incidence of the disease, William H. Smith[9] found 62 cases of adherent pericardium in 3053 autopsies at Massachusetts General Hospital during the years 1897 to 1913, or .002 per cent. Dr. Joseph C. Roper[10] found from January 1, 1909 to January 1, 1913 30 cases of adherent pericardium in 750 admissions annually at St. Mary's Free Hospital for children, or .004 per cent. Breitung[11] found the condition present in 156 of 324 cases of pericarditis, or in a fraction more than 48 per cent.

Thirty-four per cent. of Sears' series of adhesive pericarditis were accompanied by various forms of valvular disease of the heart.

In adherent pericardium, according to Hirschfelder,[12] as shown by Manges' case, complete obliteration of the pericardial sac may cause no symptoms, provided the extrapericardial adhesions remain unimportant.

The mechanical effects on the circulation due to pericardial adhesions may be threefold: (1) the work of the ventricle is increased by the tug upon the adhesions, (2) the filling of the heart may be hindered by strangulation of the vena cava, (3) the emptying of the heart and the flow through the aorta may be interfered with, as claimed by Kussmaul,[13] by the tugging of the adhesions on the aorta. These additional strains may be so great as to cause a fatal result.

Then, too, the process of compensatory hypertrophy is not a pure one, as the fibrotic process extends into the myocardium, and this is progressive until the myofibrotic carditis is advanced

and the heart failure complete, especially where relief through operation is too long delayed.

Tugging of the adhesions on auricles and ventricles may act as mechanical stimuli and produce an extrasystolic arhythmia which in itself hinders the circulation. The condition develops insidiously, as a rule, and may so continue for months or years, the patient suffering only when indulging in overexertion.

The physical signs are filling of cervical veins during inspiration, also pulsus paradoxus, both Kussmaul's observations.[13] Broadbent's[14] sign, or that of visible retraction synchronous with the heart systole of the left back in the region of the tenth and eleventh intercostal spaces. According to J. H. Broadbent,[15] systolic retraction of interspaces alone may be due to atmospheric pressure, especially when the heart is hypertrophied; but when the costal cartilages or lower end of the sternum are dragged in, there can be little doubt as to the diagnosis, as atmospheric pressure could not accomplish this result. This sign is often most marked in deep inspiration when the diaphragm is tense.

The movement during respiration of the border of the lungs overlapping the heart, which is normally 2 to 3 cm., may be reduced to 1 cm. or may absolutely disappear. This sign, though, may be due to pleural adhesions without any pericardial involvement—such cases, however, are very rare.

Diastolic shock or rebound accompanying the second sound (Broadbent) is an important sign.

In the diagnosis of chronic adhesive pericarditis, according to J. E. Summers,[16] the cardinal diagnostic signs are systolic retraction of apex, the diastolic shock, epigastric-diaphragmatic tugging, Broadbent's sign, and cardiac and pulmonary immobility.

The first *x*-ray demonstration of pericardial adhesions was made by Moritz Benedikt[17] in 1897. Stuertz[18] showed the margins of the pericardium pulled outward or downward during inspiration. *x*-Ray shows mediastinal and diaphragmatic adhesions clearly and points out operative indications.

Operative Treatment.—On this subject Sir Clifford Albutt[19]

said at the German Congress of Internal Medicine in 1904, "Brauer presented 3 patients relieved by cardiolytic resection of ribs and cartilages, Morrison[20] showed a case with good results to Harveian Society in November, 1909. Operation seems indicated if there be strong retraction of the ribs and distressful heart or dropsy and dyspnea, not relieved by ordinary means, but it requires much care and experience. Morrison's patient when I saw her was evidently much relieved and did not hesitate thankfully to say so."

J. E. Summers,[21] Omaha, Neb., says cardiolysis (Brauer[22]) or cardiathoracolysis (Kocher) has found no favor in America, and why he cannot understand, as the operation is based upon good mechanical principles, is not difficult of execution, neither has it a high mortality. According to Brauer, "whenever in pericarditis the heart becomes adherent to the mediastinum, pleura, and chest wall, a great burden is added to the work of the organ. In systole it tugs against the bony chest wall, every beat being a strain on its musculature; but the more evident the sign of tugging, the better the condition of the heart muscle and the more surely will relief come if the overlying rigid bony wall be removed, changing it into a movable elastic structure formed solely by musculocutaneous flaps. Internal adhesions of the pericardium to the heart may not of themselves be of great moment and usually are difficult to diagnose, but if, with their occurrence, the pericardium itself becomes adherent to the neighboring organs, as the mediastinum, diaphragm, sternochondrocostal wall, the function of the heart will be interferred with in a degree comparable with the elasticity of these adhesions. It is in these latter conditions, before the heart muscle itself is worn out, that Brauer proposes the operation of cardiolysis, so that the patient must be one whose heart still responds to medication and relief from all strain."

In a paper by Roux and Berger a[23] full discussion of Brauer's operation and of its results obtained to date may be found. They say that in certain cases the effect has been frankly bad or nothing at all. Nevertheless the success of the operation in the greater number of cases is acknowledged. In 21 cases clearly

favorable results have been obtained. Amelioration was even noticeable during operation in some of the cases, and immediately after operation the asystolic condition with dyspnea and edema disappeared. However, in other operations the amelioration was more tardy, and in certain cases the condition was even aggravated immediately after intervention, but little by little a progressive amelioration took place, the palpitations, edema and ascites, and enlargement of liver gradually diminished and sometimes disappeared entirely, and a number of these patients who had been condemned to inactivity were soon able to take up their occupations.

"Petersen and Simon have done Brauer's[24] operation successfully in 3 cases. The object of the operation is not to free the adhesions, but to render them harmless. Petersen advises that we should begin the operation by excising three ribs, and then, *if necessary*, remove a portion of the sternum. Very careful hemostasis is necessary, for the patient when operated on is usually very weak, but his circulation soon regains its strength, and hence hemorrhage and the formation of a hematoma may supervene.

"P. Lecéne[25] has collected 20 cases of cardiolysis performed by various German and English surgeons where there was no operative mortality, and the results were notable and durable. After operation the heart became regular, dyspnea ceased, the various forms of visceral stasis gradually disappeared, and a relatively active life became possible."

A patient aged eighteen years operated by von Beck[26] was in perfect health two years after operation and able to do gymnasium work.

Umber's[27] patient operated by Fritz-Konig was relieved for two and a half years.

Danielson's[28] patient, twenty years old, a butcher, was able to resume his work again nine months after operation.

Kuttner's case, after having been in a desperate condition, had no pain and was able to resume work six months after operation. Another patient of Kuttner's aged twenty-one years was enjoying life five months after operation.

In one of Schlayer's patients the relief continued at the end of six months.

There are 7 cases of failure. One of these, Schayler's case, died twelve hours after operation from progressive heart failure.

In Poynton and Trotter's[29] case temporary improvement, but fatal symptoms later appeared. Of the 5 others, 1 was relieved by operation, but was complicated by mitral insufficiency. In another the indications for operation had not been present, as autopsy showed simple adhesion of the two leaflets of the pericardium, with no other complicating adhesions, and was besides submitted to decapsulation of right kidney, splenopexy, hepatopexy, and omentopexy. In the 2 cases operated by Lajars the indications were not clearly present, and the first died one month and the second two months after operation.

Roux-Berger[23] conclude, "If Brauer's operation is used only in cases which are clearly justifiable one will be right in expecting good results, that is, immediate great relief, and, in truth, in a great number of cases a permanently successful outcome."

Summers has collected 38 instances of cardiolysis up to June, 1913, done in Germany, England, and France. Up to the same date, however, in this country he had been able to find not one, so that his own 2 cases are the first published ones in this country. In September, 1913 John C. Roper reported a case at St. Mary's Hospital on whom cardiolysis was made by Dr. Dowd without, however, much benefit, and the report of which could not be found.

Hirschfelder's[30] report of his case follows:

Case of adherent pericardium. The following very typical case was under the writer's care in the City and County Hospital of San Francisco. (As the original history was lost, these notes are taken from the article of Lehmann and Schmoll, who have previously published the case.)

L. A., engineer, twenty-three years old, entered the hospital complaining of headache, nausea, and shortness of breath. He had had rheumatism six years before admission, and then had pain over the heart. Since then he had had two attacks. During the past few years he has been subject to periods of heart

failure with dyspnea, during which he is frequently depressed and sometimes even maniacal.

The patient's lips, ears, and extremities are deeply cyanotic. The pulse is irregular, with numerous extrasystoles, many of them ineffectual. The apex impulse (systolic protrusion) is visible in the sixth interspace 3 cm. outside the mammillary line, beyond which there is a well-marked systolic retraction of the interspaces in front and back. There is also systolic retraction of the ribs and costal margin (Broadbent's sign). The apex is fixed and does not move with change of position, but the area of flatness changes during respiration (movement of the lung border). There is well-marked pulsation over the right ventricle. Dulness extends above to the third rib and 3 cm. to the right of the right parasternal line. A loud presystolic rumble and a loud systolic murmur are heard over the apex. The second pulmonic is markedly accentuated. Both sounds are heard with the extrasystoles.

The lungs are clear except for dulness and bronchovesicular breathing at the left base behind.

The liver is greatly enlarged and readily palpable, but there is no pulsation. There is some edema of the feet.

Clinical diagnosis: Left-sided pleurisy, adhesion of the pericardium with the posterior surface of the heart, mediastinum and diaphragm, mitral stenosis, and insufficiency.

Examination with the fluoroscope showed the heart to be dilated to right and left. There was a marked angular protrusion along the right border of the cardiac shadow. In this region the outlines of the shadow are less sharply defined than usual, merging into the liver and vertebral shadows. The diaphragm is equally high on left and right, moving less on the latter.

The patient's condition did not improve under rest and digitalis. He often had intense precordial pains. On one occasion he was subject to definite hallucinations, imagining that he saw lions, tigers, and other brightly colored wild animals springing to and fro upon the floor of the ward and over his bed, though he was at the time otherwise rational, and even realized that it was an hallucination. He was placed in a solitary cell for twenty-

four hours at his own request for fear of doing personal violence to the persons about him.

His condition became so much worse that cardiolysis was decided upon as a last resort, and was performed by Professor Stillman. The ribs were resected over the precordium and the pericardium opened in exploration. The heart was everywhere covered with adhesions, which over the anterior surface of the heart consisted of strands about 1 inch long. There was no fibrinous exudate and no fluid. The patient took the ether badly and became extremely cyanotic. The shock of the operation did him evident harm, for during his entire sojourn after that he felt even worse than before. The wound itself caused him no trouble and healed *per primam*. The patient left the hospital three weeks after the operation, in spite of advice.

Since the above 2 cases a review of the literature to date shows no new cases reported except the 2 we present, which are, therefore, the fifth and sixth American cases respectively.

CASE I.—J. E. Summers.[31] J. F., twenty-nine years, P. H., diphtheria with paralysis at eleven years of age. Illness began three years before, with bloating, tiring easily, and dyspnea with effort. Grew rapidly worse; was soon incapacitated. Could not sleep except in sitting posture. Marked venous collapse in neck. Slow retraction of apex, with a rapid diastolic thrust of left costal arch. Broadbent's sign present. Marked diastolic shock on palpation. Cardiac outline of dulness fixed, and lower border of left lung did not move with respiration.

Cardiolysis March 13, 1912, both to untether heart and give hypertrophied heart more room. Third, fourth, fifth, and sixth ribs removed with periosteum and pericondrium from sternum outward, giving a window 5 inches from above downward and $4\frac{1}{2}$ inches from within outward. Operation followed by a mild bronchopneumonia which disturbed a little the cardiac compensation. Convalescence uneventful and man was (June, 1913) free from all the distressing symptoms for which operation was done. He recommends removal of periosteum.

Later report on Case I: Patient went along with his work

for four years with practically no decompensation. Then a severe attack of decompensation set in, returned to hospital, but treatment did not influence heart, and he died four years, ten months after operation. Autopsy showed usual fixation of the pericardium in a broad mediastinal pericarditis. No adhesions between pericardium and epicardium, the latter over the left ventricle much thickened, however, indicating possible early adhesions to the pericardium. Heart not enlarged. Valves normal and competent. No coronary or aortic change. Spleen and liver showed marked passive congestion. Kidney—engorgement of vessels of glomeruli and cortex. Marked parenchymatous degeneration of proximal convoluted tubules. History after death disclosed periodic attacks of inflammation of tonsils, after which heart suffered.

CASE II.—Summers. Young lady twenty-three, four years before had dyspnea, edema, pericardial pain. History of rheumatism. Examination: Thin, anemic; slightly cyanotic, pericardial friction sound over precardia, systolic murmur at apex; apex in anterior axillary line. Veins in neck widely congested and cord-like. Orthopnea; liver enlarged to umbilicus, ascites and edema of feet and legs. Lungs: râles over bases. No fluid. Under treatment edema disappeared and pericardial rub subsided; then a distinct precordial retraction was manifest. Broadbent's sign was present.

Compensation restored and liver returned to normal size. Operated December 14, 1915. Large sections of third, fourth, and fifth ribs were removed from the sternum out. When the ribs were cut away the whole heart fell from the chest wall and found the place made for it. Operation followed by suffocating pulmonary edema, which threatened life, but this gradually disappeared. Following this, however, a rather general edema developed, which did not diminish under digitalis, although the heart seemed to be in good shape. Tappings, however, became less frequent, and she was able to go driving in auto and later drove car from Omaha to Denver, and also made a trip across Rockies, reaching an elevation of 12,000 feet without trouble.

She continued thus to overtax herself until October 31st, when she was forced to return to hospital, dying suddenly November 15th. Autopsy showed a heart that nearly filled left pleural cavity with extensive adhesions; liver was enormously enlarged.

The history of our first case was as follows:

Female, forty-one years, admitted December 9, 1918 to Barnes' Hospital. Previous diseases: Rheumatism, muscular (no arthritis), at seventeen years. Severe "bronchitis" with hemoptysis at seventeen or eighteen—probably pneumonia. Spontaneous miscarriage at seven months in 1913. Slight edema of ankles at that time. Thirteen days after miscarriage was tapped. Edema of ankles was probably due to pressure on iliac veins of the ascites.

Symptoms: Dyspneic ten years, ever since first labor, when she was orthopneic. Palpitation, edema of ankles; ascites. Tapped several times previous to entrance to hospital. First time, 1913; again, October 17, 1917; March 18th, June 18th, September 18th, November 12th, 18th, 1918. Pericardial pain, radiating to shoulders. No vertigo; no cough; no flushing, no fainting. Blood-pressure 148/70. Examination: Lips and finger-nails slightly bluish, not much edema of lower extremities, some on posterior part of thighs—all of which disappeared. Liver 8 cm. below costal margin in mammary line, not nodular. Spleen not palpable. Abdomen large, rounded, tense. Not tender. Umbilicus obliterated, no masses felt; well-defined percussion waves. Prominent venous pulsation in neck. Chest: Some diminution of fremitus and breath sounds; also some dulness over base of right pleura posteriorly; otherwise negative. Heart: Outline of cardia dulness, right, $4\frac{1}{2}$ cm.; left, 16 cm. in fifth intercostal space. Point of maximum impulse 13 cm. out in sixth space. Absolute irregularity. Aortic systolic and diastolic and mitral systolic murmurs; no impression of mitral presystolic or of Flint murmur. Dulness of heart does not shift to left as patient turns to left. Only 1 cm. change in absolute cardiac dulness on deep inspiration. Systolic retraction in region of apex; no epigastric retraction. Pleural rub at second and third right costochondral junction on sitting up. Capillary

pulse, slight systolic retraction in eleventh intercostal space in posterior axillary line. Lesions: Aortic regurgitation and roughening. Mitral regurgitation. Electrocardiogram shows auricular fibrillation. Left ventricular preponderance, irregular ventricular rhythm; atypic ventricular complexes (Fig. 89). Urine, sugar negative. Trace of albumin, no casts. Blood, red cells 5,200,000; white, 5200. Hemoglobin 80 per cent. Temperature subnormal or normal, usually around 97° to 98° F.

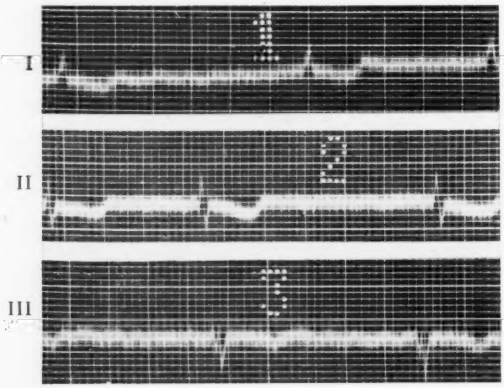

Fig. 89.—Case I. Dec. 11, 1920. On admission. Shows auricular fibrillation, rate 60. Left ventricular preponderance. T-wave inverted in all leads (digitalis effect). Patient had been on digitalis before entering hospital.

December 10, 1918: 11,200 c.c. of straw-colored fluid removed by paracentesis. Specific gravity 1014. Fluoroscopic: General increase of all lung markings, with very large hilus shadows, both sides. Heart apex within 3 cm. of costal wall. Aortic shadow apparently very wide, probably due to engorged pulmonary veins. Lung markings pulled down during systole on left side. Right oblique view shows a large left auricle projecting into mediastinal space posteriorly. The pulling down of lung markings on left side with each systole, together with the syndrome of cardiac decompensation, recurring ascites (not otherwise explainable), without, however, constant edema of

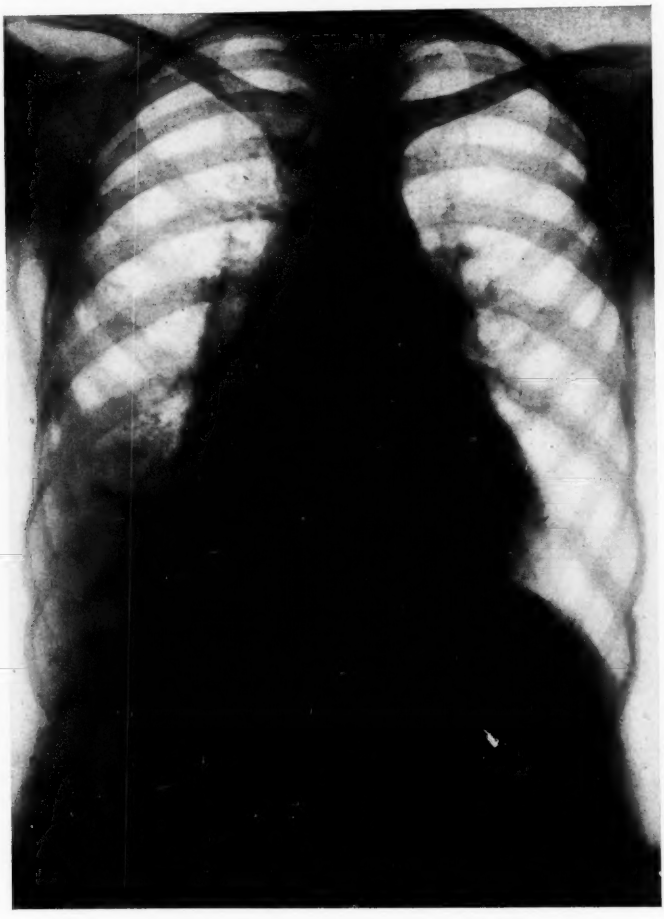

Fig. 90.—Case I. Postoperative radiogram. A distinct tugging on the left hilus markings as delineated in the above radiogram could be distinctly seen fluoroscopically with each cardiac systole.

lower extremities, made clear the diagnosis of chronic mediastinopericarditis (Fig. 90). On December 27, 1918, eighteen days after admission, Dr. Sachs resected, under general anesthesia,

left third, fourth, and fifth ribs from sternal margin to beyond area of cardiac pulsation to the left. Following operation heart was irregular, rate 135, pulse irregular. Next day no pulse deficit, heart not so irregular, no edema. Third day, still no deficit. One week later fluid made out in left chest, aspirated; 1500 c.c. bloody fluid removed.

January 6, 1919, ten days after operation: Pulse deficit 14, pulse irregular. Skin pasty, yellow; complains of dyspnea. Dyspnea and pulse deficit continued. Given 10 c.c. of tincture of digitalis.

January 7th: Pulse deficit gone, still dyspneic, but pulse stronger; later, however, prostration and dyspnea gradually became worse. On January 9th temperature went to 101° F. W. B. C. 29,000. Respiration 44. Two blood-cultures negative.

Lung findings: Diminution of respiratory murmur and presence of subcrepitant râles at both bases, pointing to bronchopneumonia (influenzal). Dyspnea and prostration increased, and patient succumbed to influenzal pneumonia January 15, 1919, twenty days after operation. Ascites did not return after operation.

The chances of this case for recovery might have been better had we operated under local rather than general anesthesia, for in this way shock was very largely prevented in our second case; then, too, the chances of bronchopneumonia would have been greatly reduced, which complication undoubtedly was the cause of the fatal termination. The fact that there was no tendency to recurrence of the ascites during the three weeks after the operation is very suggestive of ultimate marked benefit from the cardiolysis had not complications arisen.

A summary of the results of the operation as obtained from the cases herein before enumerated shows that the number of favorable results was 24, while the number of failures was 9. And the average period of relief from symptoms was about seventeen months, a showing that should establish the efficacy of the operation in this desperate class of cases.

CONCLUSIONS

1. Chronic mediastinopericarditis occurs more frequently than is usually conceded.

2. Every case of ascites not ascribable to the more common causes of this symptom should be carefully studied from the standpoint of adherent pericardium.

3. Fluoroscopy is a most valuable aid in the recognition of the condition.

4. As soon as the diagnosis is established, cardiolysis should be urged, while the heart muscle is still able to respond to the relief thereby afforded.

5. Local block anesthesia should be the anesthetic of choice, as shock, cardiac and pulmonary complications are thereby minimized.

BIBLIOGRAPHY

1. Smith, Elsworth S.: The Schott Bath Treatment of Chronic Heart Disease, Jour. Amer. Med. Assoc., 32, p. 161.
2. Pick: Ztschr, f. klin. Med., Bd. xxix, S. 385
3. Rolleston: Diseases of the Liver, Gall-bladder, and Bile-ducts, 1905, W. B. Saunders and Co., 1st ed., p. 100.
4. White, Hale: Albutt's System of Medicine, vol. iv, p. 120.
5. Flesh and Schossberger: Diagnose und Pathogenese der in Kindesalter, häufigsten Form der Concretio Pericardii cum Corde, Ztschr. f. klin. Med., Berl., 1906, lix, 1.
6 Hess, O.: Diagnose und Pathogenese der im Kindesalter häufigsten Form der Concretio Pericardii cum Corde, Ztschr, f. klin. Med., Berl., 1906, lx, 174.
7. Diemar: Zeitsch. f. Heilk., 1899, Bd. xx, S. 257.
8. Wells, H. G.: Amer. Jour. Med. Sci., vol. cxxiii, p. 259, 1902.
9. Smith, Wm. H.: Amer. Med. Assoc., Sept. 6, 1913, p. 739.
10. Roper, John C.: Med., Rec. Sept. 11, 1913, p. 689.
11. Breitung: Gibson's Diseases of the Heart and Aorta, 1898, p. 358, 1st ed.
12. Hirschfelder: Diseases of Heart and Aorta, p. 610, 3d ed., J. B. Lippincott Co.
13. Kussmaul: Ueber schwielige Mediastinopericarditis und paradoxen Puls, Berl. klin. Wchnschr., 1873, x, pp. 433–461.
14. Broadbent, Walter: An Unpublished Physical Sign, Lancet, London, 1895, ii, 200.
15. Broadbent, J. H. F.: Heart Disease and Aneurysm of the Aorta, New York, 4th ed., 1906.
16. Summers, J. E.: Amer. Jour. Surg., June, 1913.
17. Benedikt, M.: Wien. Med. Wchnschr., 1897.
18. Stuertz: Zur Diagnose der Pleuraadhäsionen aus Pericard und Zwerchfell, Fortschr. a. d. Geb. d. Röntgenstr., Hamb., 1904, vii, 215.

19. Allbutt, Sir Clifford: Musser and Kelley, vol. iv, p. 488.
20. Morrison, Alexander: On Thoracostomy in Heart Disease, Lancet, July 4, 1908; November 20, 1909.
21. Summers, J. E.: Jour. Amer. Med. Sci., vol. xxvii, No. 6, June, 1913.
22. Brauer: Die Kardiolysis und ihre indicationen, M. M. Woch., 1902, xlix, p. 982.
23. Roux and Berger: Le Lemaine Medicale, Sept., 1910, Le Treatment Chirurgical de la Mediastino-Pericardite Adhesive.
24. Brauer: Centralblatt für die Grenzgebiete der Medizin und Chirurgie, vol, 9, Nos. 11–14.
25. Binnie: Operative Surgery, 7th ed., p. 336.
26. Von Beck: Quoted from Brauer.
27. Umber: Perikarditis und Mediastinale Verwachsungen und Cardiolysis, Therap. d. Gegenwart, 1905.
28. Danielson: Beiträge z. klin. Chir., No. 1, 1907.
29. Poynton, F. J., and Trotter, W.: The Operation of Cardiolysis, Lancet, London, June 19, 1909.
30. Hirschfelder: Diseases of Heart and Aorta, p. 618, 3d ed., J. B. Lippincott Co.
31. Summers, J. E.: Jour. Amer. Med. Sci., vol. xxvii, June, 1913.

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THE USE OF 5 PER CENT. VEGETABLES IN THE TREATMENT OF DIABETES MELLITUS

RESTRICTION of the carbohydrate foods in the treatment of diabetes has been practised since the time of the discovery of the disease. The use of the various foods as vehicles for this restriction is rather interesting. The vegetables were early recognized as possessing little carbohydrate, so little, in fact, that the tolerance of patients for carbohydrate was worked out by determining the amount of bread that might be consumed without glycosuria. It was long believed that some carbohydrate foods were better tolerated by diabetics than others, and the old literature is full of the oat, potato, milk, and other cures. In fact, we still find physicians who believe that every diabetic should be tried out on various forms of carbohydrate. Von Noorden first used a green vegetable day, during which he allowed diabetics only vegetables and eggs. Janeway's strict diet is an illustration of the low carbohydrate or "carbohydrate-free" diet. In it he makes good use of the green, or 5 per cent. vegetables, but at the same time adds an overabundance of fat. So it may be seen that from the time when it was thought quite necessary to have bread or some starchy food in the diet, clinicians came to use more and more the bulky vegetables, and found, even in the days before the starvation or inanition form of treatment was adopted, the value of these vegetables.

With Allen's introduction of starvation treatment this clinic followed very carefully his instructions as to the conduct of star-

vation. Irrespective of the tolerance for carbohydrate the patients were starved. It was very soon found out that rather severe acidosis followed the period of complete starvation, even in relatively mild cases. The Rockefeller monograph on the treatment of diabetes brings out clearly the dangers of acidosis with complete starvation and makes its application possible only where hospital facilities are available, and especially a well-equipped laboratory. So impressed were we with the depression and weakness of the patients during and following acidosis that some modification of the starvation routine was thought worth while trying out. Instead of complete starvation, with but water, coffee, tea, and bouillon, 400 grams of the 5 per cent. vegetables or 20 grams of carbohydrate were given. The difference was so striking and the result so satisfactory that for the past five years the use of green days instead of complete starvation has been practised in this clinic.

To demonstrate beyond a doubt that the carbohydrate in the 5 per cent. vegetables is available to the animal, experiments with phloridzinized dogs were undertaken. In addition, these vegetables were analyzed by an enzyme, and results compared by the two methods. In brief, it was shown that by feeding large enough quantities of cabbage and cauliflower to completely diabetic dogs the extra glucose eliminated closely checked with the analysis by the diastase method. It was thus demonstrated that in spite of the character of the starch and organic acids in these vegetables, and its association with a relatively large amount of cellulose, it was available as glucose to the animal. An important fact was brought out by these experiments, namely, that the carbohydrate in these vegetables is very slowly absorbed by the alimentary tract. It was found that to recover the extra glucose after feeding cabbage and cauliflower to diabetic animals the urine in post-feeding periods must be collected for twenty-four hours, that is, the D : N ratio did not return to the starvation level short of that time. An illustrative table is shown on page 867.

PHLORIDZINIZED DOG FED CAULIFLOWER

Time, hours.	D : N.	Extra sugar.	Remarks.
6	4.95		
6	3.23		
6	3.13		
24	4.18	17.1	500 grams of cauliflower fed at beginning of period.
6	3.55	1.6	
6	3.37	0	
6	3.31	0	

The time element is of extreme importance in the estimation of carbohydrate tolerance. Thus, if a patient passes no sugar when fed 20 grams of carbohydrate in the form of 5 per cent. vegetables, he might easily show sugar if fed on the same amount of pure sugar or starch, the latter being absorbed in two to six hours, as shown repeatedly by various workers; while our work goes to show that the carbohydrate in 500 grams of 5 per cent. vegetables is only absorbed in twenty-four to thirty hours. There can be no question that the amount of cellulose in the carbohydrate foods influence markedly its absorption rate by the intestinal mucous membrane. The ideal carbohydrate food for the diabetic would be one which permitted a slow steady trickle of glucose into the blood-stream during the whole of twenty-four hours instead of the flooding of glucose into the portal system during the first four hours following a meal. These cellulose-carbohydrate foods, therefore, fulfil the diabetic requirements better than any other of the carbohydrate foods.

The advantages, as we have found them, of the green days over the complete starvation treatment may be summarized under five heads:

1. Starvation acidosis is prevented, and when present rapidly clears up with 20 to 40 grams of carbohydrate in the form of the 5 per cent. vegetables. As pointed out, the trickle of glucose from these foods over the whole twenty-four hours supplies enough carbohydrate when supplemented by carbohydrate from body protein to completely metabolize fat. This is true even in the severest of diabetics. We have never seen acidosis appear during or following starvation when 20 grams of carbohydrate

in the form of the 5 per cent. vegetables were fed during starvation days.

Furthermore, the glycosuria clears up as rapidly, in our experience, with two or three green days as with total starvation. The green day does not supply enough calories to prevent the full effects of starvation, but it does supply enough carbohydrate to prevent acidosis. In the very severe case it may be necessary to progress from the green days to "thrice boiled vegetable" day of Joslin. But very rarely is this necessary.

Tables of the laboratory findings in three severe diabetics are shown to illustrate the rapid fall in acidosis with the green day starvation. The presence of acidosis was indicated by the strongly positive ferric chlorid reaction, the large amount of ammonia in the urine, and the low carbon dioxid volume per cent. in the blood. The latter in all 3 cases being between 30 and 40 volumes per cent. It is to be noticed that the acidosis cleared up several days before the urine became sugar free. The relatively large amounts of basic ash in these vegetables may play a part in the rapid improvement of acidosis.

2. The property of carbohydrate for saving body protein is very well known. How even very small amounts of carbohydrate when well tolerated by the diabetic will exhibit this property can be demonstrated. Case N was put on a purely experimental diet with the purpose of producing a mild acidosis. During six days on a diet of 32 grams of protein, 150 grams of fat, and 10 grams of carbohydrate a moderate acidosis was produced and an average total N. excretion of 13.2 grams. The following six days the diet was the same except the carbohydrate was increased 10 grams. The average total N. excretion fell to 9.2 grams per day. The creatinin excretion averaged the same in both six-day periods. Here by adding 10 grams of carbohydrate to the diet in the form of green vegetables an average of 4 grams of body N. was spared daily. No more striking demonstration of the protein-sparing property of carbohydrate can be found in the literature. The experiment further shows how the addition of 10 grams of carbohydrate to the diet can clear up acidosis. This throws light

CASE N

	URINE.						FOOD.		
Date.	Amount.	Creatinin, gm.	Total N., gm.	Ammonia N., gm.	Sugar, gm.	Ferric chlorid.	Carbohydrate.	Fat.	Protein.
11/24	1880	1.60	12.9	1.12	0.0	+	9.9	151	32
11/25	1620	1.37	18.8	1.85	0.0	+	9.9	151	32
11/26	1650	1.39	11.3	2.00	0.0	+	9.9	151	32
11/27	450	1.57	11.85	2.23	0.0	++++	9.9	151	32
11/28	1770	1.64	12.6	2.16	0.0	++++	9.9	151	32
11/29	1740	1.43	14.4	1.90	0.0 Av. N.	++++	9.9	151	32
11/30	2170	1.70	14.0	2.30	0.0 13.2	++++	9.9	151	32
12/1	2080	1.59	12.2	2.28	0.0	+++	9.9	151	32
12/2	1840	1.42	12.4	1.92	0.0	+++	20	151	32
12/3	2060	1.42	10.4	1.58	0.0	+++	20	151	32
12/4	2420	1.51	9.5	1.91	0.0	++	20	151	32
12/5	2640	1.67	9.5	1.89	0.0 Av. N.	++	20	151	32
12/6	2650	1.51	8.2	1.83	0.0 9.2	++	20	151	32
12/7	2860	1.58	9.13	1.61	0.0	+	20	151	32
12/8	3200	1.49	8.60	1.93	0.0	+	20	151	32

on the mechanism of the prevention of acidosis by the use of the green day, and explains why such a small amount of carbohydrate as 20 grams can prevent starvation acidosis in the diabetic. Another similar experiment on a mildly diabetic patient is shown in the table of Case C. Here the protein saving averaged only 0.5 gram per day, but the striking clearing up of acidosis by the addition of 10 grams of carbohydrate to the diet is again demonstrated. The body protein-sparing property of the green day and its prevention of starvation acidosis go hand in hand.

3. A point not to be overlooked has to do with the patient himself. Starvation in itself does not prostrate the patient, but the idea of going without food often does—500 grams of bulky vegetables goes a long way in preventing loss of mental stamina. Something to eat, even if only boiled cabbage, cauliflower, or asparagus, makes the starvation day very much less hard for the patient. We have found, for this reason and others already cited, that starvation can be prolonged to a greater period than when patient is completely starved. Case R illustrates this point well.

4. The old arteriosclerotic patient in the sixth decade stands starvation poorly. He is easily prostrated and rallies poorly after starvation. His disease, too, is, nine cases out of ten, mild. For him we believe starvation is contraindicated. If he cannot be made sugar free on carbohydrate reduction, we make use of the "double green day," that is, 40 grams of carbohydrate as 5 per cent. vegetables. This gives him a bulk of 800 grams of vegetables. Often this proves too bulky and a few fruit juices and vegetables of 10 per cent. class are used. On such a procedure the patient hardly realizes he is being starved, and the oldest and the one suffering from cardiorenal disease tolerate two days of such régime very well.

5. As well brought out by its author, complete starvation is only to be thought of where hospital and laboratory facilities are available. However, two or three green days may be used by the practitioner with the assurance of safety. We believe the severe diabetic can only be treated in a hospital, but certainly the average diabetic can safely take two or three green days under the direction of his physician without danger of acidosis.

CASE C

	URINE.							FOOD.		
Date.	Amount, c.c.	Sugar, gm.	Ferric chlorid.	Creatinin, gm.	Ammonia N., gm.	Total N., gm.	Total acetone bodies, gm.	Carbohydrate, gm.	Fat, gm.	Protein, gm.
9/23	1800	0	0	1.34	0.50	5.46	....	9	146	31
9/24	1260	0	+	1.40	1.03	6.17	4.3	9	146	31
9/25	2350	0	0	1.38	1.00	7.20	2.4	9	146	31
9/26	2140	0	++	1.39	2.17	6.44	5.8	9	146	31
9/27	1450	0	++	1.40	2.04	7.10	8.1 N. daily average 6.9	9	146	31
9/28	2490	0	++	1.50	2.23	7.68	8.1	9	146	31
9/29	2040	0	0	1.32	1.95	6.25	4.3	9	146	31
9/30	1420	0	0	1.36	1.41	5.41	3.4	19	146	30
10/1	1920	0	0	1.43	1.53	6.90	5.3 N. daily average 6.2	19	146	30
10/2	900	0	0	1.36	1.20	5.50	3.5	19	146	30
10/3	1800	0	0	1.32	1.27	7.08	2.9	19	146	30
10/4										

CASE R

Date.	URINE. Sugar, gm.	Ferric chlorid.	Ammonia N., gm.	Total N., gm.	Creatinin, gm.	Organic acids, c.c. n/10 acid.	BLOOD. CO_2 vol. per cent.	FOOD. Protein.	Fat.	Carbohydrate.
5/8	131	++++	....	....	....	4410	....	100	99	61
5/9	38	++++	3.41	12.1	1.28	2720	....	8	2	21
5/10	64	++++	3.15	10.4	1.31	2890	36	8	2	21
5/11	61	+++	2.77	8.2	1.81	1960	54	11	1	61
5/12	39	+++	2.09	11.2	0.90	1870	....	16	3	40
5/13	31	++	2.08	7.8	1.06	1780	....	16	3	40
5/14	20	++	2.25	6.5	0.97	1620	....	16	3	40
5/15	36	0	1.50	6.2	1.39	1270	....	16	3	40
5/16	27	0	1.78	9.6	1.20	980	....	8	2	21
5/17	13	0	1.41	5.7	0.82	....	....	8	2	21
5/18	12	0	1.24	6.0	0.85	....	....	8	2	21

PROTOCOLS

Case J.—Female, age twenty-three; American. Family history negative. Duration nine months. Starvation days: four double green days (carbohydrate 40 gm.) and three single green days (carbohydrate 20 gm.). Became sugar free on the second single green day. Weight 100 pounds. Diet on discharge from the hospital: Protein, 75 gm.; fat, 50 gm.; carbohydrate, 20 gm.

Case M.—Male, age fifty-one; American. Weight 110 pounds. Other diagnoses: Arteriosclerosis, general, and tuberculosis, pulmonary. Starvation days: three double green days, three single green days, three thrice cooked vegetable days. Sugar free at the end of the thrice cooked vegetable days. Duration of disease two years. Diet on discharge: Protein, 100 gm.; fat, 125 gm.; carbohydrate, 20 gm.

Case R.—Female, age twenty-one; American. Weight 140 pounds (reduced to 125 pounds in the hospital). Duration of disease eight months. Mother died of diabetes. Starvation days: two single green days, five double green days, four single green days, four thrice cooked vegatable days—total starvation days fifteen. Sugar free on the fortieth day of hospital treatment and continued sugar free for forty days before discharge. Diet on discharge: Protein, 75 gm.; fat, 75 gm.; carbohydrate, 10 gm. At one time while in the hospital and during an attack of acute tonsillitis had a D : N of 3.

CASE J

Date.	URINE. Amount, c.c.	Sugar, gm. per cent.	Ferric chlorid.	Ammonia N., gm.	Organic acids c.c. per K.	Total N., gm.	Creatinin, gm.	BLOOD. CO_2 volume per cent.	FOOD. Protein, gm.	Fat, gm.	Carbohydrate, gm.
9/2	?	3.8	++++	....	92	....	....	34	74	48	40
9/3	?	5.0	++++	....	....	....	....	46	74	29	40
9/4	3500	92.0	++++	....	....	....	....	66	74	2	40
9/5	?	2.3	+++	2.66	35	10.98	1.27	56	74	2	40
9/6	3900	105.0	++	2.60	....	9.56	1.51	....	74	2	40
9/7	?	2.0	++	1.81	....	9.85	0.72	....	50	1	40
9/8	1640	33.0	++	1.06	....	8.17	0.67	....	40	1	40
9/9	1940	33.0	++	1.00	....	6.77	0.64	....	0	0	40
9/10	1560	20.0	+	0.90	....	....	0.62	....	16	3	40
9/11	2400	12.0	0	1.39	....	5.78	0.70	....	0	0	40
9/12	1950	8.0	0	1.85	....	6.20	0.71	....	16	3	40
9/13	2550	6.0	0	....	....	....	....	....	8	1	20
9/14	2325	0.0	0	....	....	....	....	....	8	1	20

CASE M

Date.	URINE. Sugar, gm.	Ammonia N., gm.	Ferric chlorid.	Total N., gm.	Creatinin, gm.	BLOOD. CO_2 vol. per cent.	FOOD. Protein.	Fat.	Carbohydrate.
4/7*	76	1.35	+++	8.9	....	30.9	17	3	41
4/8	55	2.84	++++	10.4	....	....	17	3	41
4/9	58	2.07	++++	10.9	....	50.0	17	3	41
4/10	13	2.08	++++	11.2	0.89	....	8	2	21
4/11	44	1.52	+++	9.6	0.86	....	8	2	21
4/12	30	1.06	++	4.2	0.90	56.0	8	2	21
4/13†	9	0.94	+	7.3	0.62	....		Thrice cooked.	
4/14	5	0.92	+	7.3	0.56	....		Thrice cooked.	
4/15	15	1.13	+	13.2	0.91	....		Thrice cooked.	
4/16	4	1.38	0	20.3	0.95	....	40	1	21
4/17†	0	0.54	0	10.6	0.57	69.0	51	0	4

* Twelve hours. † Incomplete.

CLINIC OF DR. DREW LUTEN

BARNES HOSPITAL

ERRORS IN THE DIAGNOSIS AND TREATMENT OF HEART DISEASE

IN inviting your attention to some of the commoner errors in the diagnosis and treatment of heart disease certain fundamental conceptions will be reviewed and briefly discussed. For it is only in losing sight of fundamentals that serious mistakes are likely to occur, and there is always a value in going over again and systematizing our ideas.

Definition.—By the term "heart disease" obviously is meant disease of the heart, and yet the term is so broad and includes so many and such varied conditions that a more exact definition should be fixed as a preliminary to any discussion of the subject. A series of definitions doubtless would show a wide variation. If a cut on the finger heals by primary union, can it be said that the finger is diseased? Suppose a scar results, but strength and motion have been left unimpaired. Is the finger diseased? Or suppose, instead of primary union, infection had resulted, but only a scar finally remained, there being no loss of function. In such a case could the finger be spoken of as a *diseased* finger? Suppose, again, that one-half of the terminal phalanx had been removed, leaving little or no impairment of use, could it properly be said that the finger was still the seat of disease? Obviously a negative answer must be given to such considerations. Suppose, then, that a trivial injury has befallen some part of the heart, but that healing has been complete and that there has resulted no loss of function or efficiency. Such a heart, surely, is not a diseased heart, and the subject in such a hypothetic case could not be said to have heart disease. Sup-

pose, again, that the trivial injury in question had befallen the mitral valve, and that the scar of healing, while very small, had yet left the slightest possible distortion of the valve so that closure was not quite complete, though all other parts of the heart were unaltered. A very small amount of blood, let us say, returned into the auricle with each ventricular systole, and a slight murmur might be audible at the apex. Suppose the subject in such a case were well able to do his work, experienced no more marked symptoms than other men when engaging in common exercise, and had, indeed, no further signs or symptoms referable to his heart. Could such a heart, exhibiting only a small healed lesion and with function not at all impaired, be properly spoken of as a diseased heart? Here again a negative answer must be returned.

But let there be supposed a case in which more serious damage had befallen the heart, the muscle had been damaged slightly; dilatation, perhaps, resulted in small degree when extra work was called for. Such a heart might respond satisfactorily to the usual needs of the body, while being unable to supply emergency demands in full measure. In such a case there might well be little superficial evidence of heart trouble; the question indeed of present "disease," in its narrower sense, might be an open one; yet such a case must be included within the general term of heart disease.

It at once becomes necessary to attempt a definition of terms. The difference between the two hypothetic cases just cited may not involve at all the question of quantitative pathologic change. Indeed, the seriousness of a heart lesion cannot be measured by its extent any more surely than can such a standard be applied to a cerebral lesion. The difference may not in any sense be merely a difference in degree. In the one case under consideration above the heart's efficiency was not lowered; in the other there was diminished power even though the signs may have been so slight as to escape notice. In the one case the heart functions well at all times even though there may be a more or less pronounced murmur. In the other, function is impaired even though abnormal signs may be slight. The question, of course, is not

one of pathologic anatomy except in so far as this may affect function. But if there is present pathologic function there is present *heart disease* in its true sense, however difficult or easy its diagnosis may be.

Heart disease, then, may be defined as any condition which is causing, or which must of necessity cause, disordered heart function; any condition which embarrasses the heart in its duty to the organism or which must eventually lead to such embarrassment. The duty of the heart is to serve as a pump, and just as any power system must be powerful enough to meet emergency demands, so the heart is constituted so as to be able to meet demands that are not made upon it at all times. If it is able to meet these demands for extra work, and no condition is present which will subsequently lessen its ability to do so; in other words, if the level of its potential capacity above its routine requirements is as high as it should be, then the heart can hardly be regarded as the subject of disease, no matter what sounds may be heard near it or what interesting phenomena may be associated with its action. The important question in any case is not so much whether a particular valve is or is not competent, whether there is or is not hypertrophy, or whether a certain arhythmia is present. The important question is whether the heart is and will be able to meet the demands for work that may be made upon it. Or, in other words, the consideration of prime importance is a proper estimate of the present *functional capacity* of the heart and of any condition that may subsequently modify its capacity.

It need not be stated that an understanding of the meaning of murmurs, measurements, and arhythmias has an importance that cannot be overestimated. Signs and symptoms must be understood, and they must be interpreted in terms of pathologic anatomy. He who has an imperfect understanding of the underlying pathologic lesion cannot estimate the effect which the latter produces, nor can he form a fair conception of changes that may be anticipated. But even those changes and an understanding of them are of importance only in so far as they affect and may be expected to affect heart function. A valve le-

sion, a muscle involvement, or an arhythmia is of no consequence to the patient provided his heart meets all demands and will continue to do so. The important questions are: How well does the heart perform its duty? How well may it be expected to meet the demands that will be made upon it? An error, then, that is not infrequently made consists in the failure to appreciate the fact that certain signs which attract attention may not be indicative of *heart disease*. They may be associated with no impairment of function and no indication of future involvement may obtain.

A functional heart test, a quantitative test of the heart's capacity, more or less analogous to a kidney functional test or a test of stomach function, would be a desideratum. No very satisfactory clinical test, however, for measuring exactly the capacity of the heart has been devised. But, although no means are at hand of graduating heart power, a fairly accurate determination of heart capacity may readily be arrived at. And just as one estimates kidney function or stomach function by giving a certain task to the kidney or to the stomach, and then determining how well the task had been performed, so one determines heart function in the same way. A discussion of the various more or less generally used heart functional tests is not here in order. While none of them admits of as much exactness as many other functional tests allow, it is nevertheless true that approximate heart capacity at least can be rather easily determined. And it must be determined if one is to diagnose and treat properly cases of heart disease. In the failure to do this lies a rather common error.

In thus determining approximately the functional capacity of the heart by observing how well it performs a given task, the standard that is employed is the character of the heart's response to a demand made upon it for work. Bodily exercise necessitates heart work, and is accompanied by certain well-known symptoms and signs which vary in inverse proportion to the degree to which the heart is meeting its demands. To gage the capacity of the heart, then, one notes the intensity of the symptoms and signs that accompany a certain piece of work.

Or one notes the amount of exercise that calls forth the symptoms and signs of excessive demands upon the heart; the amount of work the heart can perform before the evidences of excessive work appear.

Whatever specific tests one may prefer, the most important consideration in arriving at a proper notion of the heart's capacity is *the patient's history*. In this is recorded a large part of the data of a complete functional test, a record of cardiac response to varied demands made by emotion, digestion, bodily and mental work. And he who fails to elicit a complete and often painstakingly acquired history, but hurries to use some more easily applied test, will fail to appreciate slight impairment of function and will fail to recognize certain early cases of heart disease. With the modern tendency to hurry to and depend upon so-called laboratory methods of diagnosis, the danger of disregarding the laboratory notes recorded in the patient's own history needs emphasis. It is an error that is not infrequently made. In a heart that is extremely incompetent the slightest exertion may give rise to breathlessness, pain, and fatigue; or these symptoms may be present without exertion, the heart being unable to meet its routine demands in a satisfactory manner, and further evidences of incompetence, such as cyanosis and engorgement, may be present. Serious mistakes are unlikely here. But in the earlier case, in the case of the heart whose capacity is only a little impaired, the failure to take into account a complete history may lead to error.

The opposite error is perhaps, or at any rate until rather recently was, more common. Suspicious signs are present. A diagnosis of heart disease is made and the patient advised to alter his course of life without the examiner's having taken into account the fact that there is no impairment of function and no evidence that such impairment will ensue. Here again, of course, in arriving at a proper conception of heart function the history lends great weight.

The importance of murmurs in arriving at a proper conception of the state of health of the heart and its functional capacity is often exaggerated. Indeed, the question of a valve lesion *per se*

has been given a prominence that is relatively too great. Of much more importance is the question of *muscular damage*. In fact, murmurs, valve lesions themselves, are of importance mainly in so far as they give an indication of the muscular involvement which may be expected to accompany them. A case exhibiting a stenosis of the mitral valve has a serious prognosis not so much because of the damage to the valve as because of the serious damage to the muscle that is almost surely present.

The experience gained from examining the nation's young men about to enter upon military service enlarged our knowledge of the relative importance of the systolic murmur, and it is not as common as it was a few years ago to make a diagnosis of heart disease upon such evidence alone. How many men were rejected from the draft upon no evidence other than a systolic murmur at base of apex! And how many of these men and others have since filed claims for compensation because of such findings!

We recently examined a man who was working at the arduous labor of a molder without discomfort, and who had no history of symptoms that could fairly be attributed to heart disease. And yet the government is paying this man about $20 a month because he has a recorded diagnosis of "mitral insufficiency." What really concerns the government in his case is not whether the man has or has not a mitral systolic murmur of a certain intensity, but whether he is able to do his work, and whether there are any evidences that his capacity for work will ever be decreased because of heart disease. Lewis[1] says that "systolic murmurs, soft, harsh, or conducted, are natural phenomena when the organ is accelerated by exercise." Whether one may agree to that statement or not, it is still not uncommon, despite the lesion of the draft, for a diagnosis of heart disease to be made upon the existence of a systolic murmur, with no evidence of impaired function, with negative history and symptoms and with no further physical signs.

Some of the symptoms that are associated with heart disease may arise from other causes. Undue breathlessness and ex-

[1] Lewis, Thomas: Cardinal Principles in Cardiological Practice, British Medical Journal, No. 3072, p. 621, November 15, 1919.

haustion, for example, may be the result of an anemia in a patient who exhibits no evidence of heart disease. Such considerations apply to all problems of diagnosis. Not upon the history of certain symptoms alone, of course, should diagnosis be made. Neither should a complete diagnosis be made without a careful history and an estimate of heart capacity.

By forming a conclusion without such evidence failure in both directions will be inevitable: (*a*) Early cases of heart disease will be missed; (*b*) normal hearts will be diagnosed as diseased.

Another error that is becoming less frequent is a failure to differentiate correctly the arhythmias. It is usually possible to do so without an electrocardiogram. A patient may show a mild or severe decompensation or, indeed, give no evidence at all of diminished function while exhibiting a certain arhythmia. A clear understanding of the type of this arhythmia is not necessary in order to estimate the functional capacity of the heart. It is of importance in estimating the gravity of the condition and it is essential for correct prognosis and treatment. And yet how often are such cases dismissed with the notation that the "heart action is irregular"!

The treatment of a case of decompensation that exhibits an "irregular heart action" cannot be undertaken with confidence unless the diagnosis has been complete enough to include the irregularity. The man who gives large doses of digitalis to such a case with auricular fibrillation and achieves strikingly favorable results will be disappointed when his failure to differentiate cases with premature contractions leads him to anticipate in these cases results equally fortunate. The differentiation between these conditions in most cases is not difficult. Here again one must translate the clinical condition into pathologic anatomy and physiology.

Before considering the underlying pathologic situation in these two conditions let us pause for a moment to review a few points in the anatomy and physiology of the normal heart-beat. The different areas of the heart, you remember, vary in the degree of their inherent rhythmicity; and rhythmicity is greatest at the sinus area near the mouth of the great veins. The impulse to

contraction and the contraction wave itself begins at this pacemaker, spreads downward over auricles to ventricles, and is conducted to the latter along a bundle of specialized tissue, the bundle of His. Now the vagus nerves hold the heart in check. They depress rhythmicity and they depress conduction. This depression of rhythmicity is usually exercised by the right vagus more than by the left, while the latter usually influences conduction to a greater extent than does the right vagus. When the rhythmicity of some other area becomes relatively greater than that of the pacemaker, through diminished vagus control of this area or otherwise, such an ectopic focus may initiate a contraction. Such a contraction, whether arising in auricle or ventricle, is called a premature contraction or an extrasystole.

In auricular fibrillation, on the other hand, an entirely different condition obtains. There is no orderly spread of impulse and contraction from pacemaker to bundle. Separate auricular fibers contract independently, and multitudinous impulses spread toward the ventricle.

When some hyperirritable ectopic focus, then, instead of waiting for the auricular contraction wave to spread from the physiologic pacemaker, initiates a contraction prematurely, a so-called extrasystole results. But when individual auricular fibers contract independently, with no synchronous or united action, the disordered auricle is powerless to contract. Instead of the auricle's sending down through the bundle regular impulses to the ventricle, the latter receives the disorderly fibrillary impulses as they crowd down the narrow path, and being called upon when in varying stages of rest and preparation, responds as best it may and with contractions that vary in force and rhythm. Digitalis, by stimulating the vagus, depresses the conductivity of the bundle of His and thus allows an overworked ventricle to rest and restore its efficiency. But the fact that it does this is no indication that it may depress the irritability of an ectopic focus, which may, indeed, not be under vagus control at all. But since rhythmicity elsewhere may be depressed by digitalis, ectopic beats are frequently more common under its administration.

Another error which is becoming much less common arises

in cases that exhibit aortic insufficiency. It is, however, still occasionally overlooked that aortic insufficiency in an adult with evidence of no other valve lesion and without a history of acute infectious arthritis almost surely is due to syphilis. To expect such cases to receive greater benefit from digitalis than from specific treatment will lead to disappointment.

Digitalis.—Certain effects of digitalis have long been known to pharmacologists, but it is only in more recent years that much progress has been made toward a clear understanding of its action clinically. Its use in cases of decompensation with auricular fibrillation, particularly those cases with rapid pulse, is one of the best examples of the specific action of a drug. It acts in these cases by virtue of its depressant effect upon auriculoventricular conduction. The work of Hatcher, Eggleston, Robinson, and others has established the administration of digitalis in auricular fibrillation upon a very definite and exact basis. "Massive" doses, whose amount is calculated upon the basis of the patient's body weight, when given by mouth may be expected to produce effects within a few hours.[1] Yet the statement is still frequently made that digitalis requires from twenty-four to forty-eight hours to show results.

In cases of auricular flutter also digitalis exerts a favorable influence by the same depressant action. But there is little evidence that it is of value in any other type of case. Christian and others have observed improvement in patients with normal cardiac mechanism when under digitalis administration which they attribute to the drug. The evidence that this improvement was due to digitalis is, however, to say the least, much less definite than is a vast amount of evidence in the other type of cases. Lewis says that the reduction of ventricular rate is the only known important action, and that there are few cases aside from those showing auricular fibrillation in which digitalis is surely beneficial. Its use, however, in almost all types of heart disease, with widely varying methods of

[1] Robinson, The Rapidity and Persistence of the Action of Digitalis on Hearts Showing Auricular Fibrillation, Amer. Jour. Med. Sci., No. I, vol. clix, p. 1121, January, 1920.

administration, is one of the most wide-spread of medical practices.

The mistake in such indiscriminate use is perhaps not so much in the giving to such widely different cases of a drug whose clinical action is so little understood, as in the lack of a clear-cut therapeutic policy in administering it. Its rapid and striking beneficial effects in cases of auricular fibrillation (and flutter), little understood until the past few years, have doubtless caused its use to be extended to almost all other abnormal heart conditions which until recently were more or less undifferentiated. Careful consideration, however, forces the conclusion that there is little evidence of its value in these other cases. But simply because it has not been proved to be of value in these other conditions, the opposite conclusion is not justified, *i. e.*, that it surely is not useful in them also. This in itself, to be sure, would constitute no justification of its extensive use in these other cases. But while the evidence of its value is slight and perhaps indefinite, still there is some positive evidence. Its empiric use for so long must be remembered. And recently Cohn and Levy[1] have found that while having the opposite effect upon cats, it did, in the greater part of their experiments upon dogs, increase the contractile function of the heart muscle and increase the volume output.

The whole question of the beneficial effect of digitalis upon cardiac cases with normal mechanism, therefore, is an unsettled one, and the mistake in its administration to such cases lies in the non-recognition of that fact. With this consideration in mind, its use in many such cases is not only justifiable, but advisable. But even then erroneous conclusions are unavoidable unless specific evidences of its effect are watched for. One might just as wisely give tincture of cinchona to cases of heart disease and base his ideas of its efficacy upon the degree of clinical improvement of the patient (while getting the drug and remaining in bed), as to gage the clinical effects of digitalis in

[1] Cohn and Levy: Effect of Therapeutic Doses of Digitalis on the Contraction of Heart Muscles, Jour. Amer. Med. Assoc., vol. 74, p. 1597, June 15, 1920.

the same manner. A common error, then, in administering digitalis is in not giving it confidently in one type of cases and experimentally in the other.

Next to the indiscriminate use of digitalis in the treatment of heart disease, the commonest mistake lies in the failure to supervise carefully and exactly the activities of the patient after his compensation has become re-established. The period of convalescence from almost all diseases, indeed, is too often neglected, and more urgent demands upon our time occupy our energies. Full recovery of various organs after an acute illness is a rather slow process at best, and the necessary reserve of bodily strength is only gradually accumulated. How much more is this true in the case of an organ whose efficiency has been permanently impaired. The heart case is too often dismissed with a few general directions about "not indulging in strenuous exercise," and all too soon another break occurs.

More and more, however, the activities of cardiac patients are being supervised and rather accurately graduated amounts of work allowed. Of course, this can be done only when there is a fairly exact conception of the functional capacity of the heart in question. A measurement of heart power, then, becomes necessary not only for accurate diagnosis but also for intelligent treatment. The heart, generally speaking, requires exercise to maintain health. It is important, therefore, to prescribe the optimum amount of exercise; enough to produce and maintain tone, not enough to exceed capacity. In this, as in all other treatment, the amount of the dose must be controlled by observation of results.

The various organizations having to do with occupational therapy and the finding of suitable occupations for the handicapped are beginning to take account of these considerations in a practical way. Such work is being organized in several places, and patients with chronic heart disease are carefully studied and subsequently placed in occupations that may not only help them make a living without further injury to themselves, but even improve their health. The larger aspects of such organized work from the standpoint of public health and of changing the

status of those who may become public charges into producers do not concern us here. The point is, that all too often the treatment of patients with heart disease stops too abruptly with return of cardiac compensation, and that with the increase of organized facilities for continued oversight of charity patients the well-to-do may not be as well looked after in this respect as the poorer classes.

To summarize then: Certain more or less common errors in the diagnosis and treatment of heart disease are noted and briefly discussed. The one of prime importance, perhaps, is the failure to interpret signs and symptoms in terms of pathologic anatomy and physiology. Heart disease means impairment of function, present or future. It is not concerned primarily with the question of anatomic lesion. The latter is of importance only in so far as it may indicate the former.

It is an error not to gage the functional capacity of the heart. The history offers a means of doing this whose importance is not infrequently neglected. In neglecting the history, one of two opposite errors is likely to occur: (1) The failure to detect early cases of heart disease which exhibit few signs; (2) the mistaking of cases with unimportant signs for cases of heart disease. The relative non-importance of the systolic murmur is still occasionally unrecognized.

The arhythmias are sometimes not differentiated. Proper treatment requires that they be recognized.

Digitalis is used too indiscriminately. In auricular fibrillation (and flutter) it is specific. In other cases its use should be experimental.

Treatment too often ends with return of compensation. The amount of heart work allowed after a break should be carefully adjusted to cardiac capacity, and chronic cases should be carefully followed and observed with this end in view.

CLINIC OF DR. JULES M. BRADY

ST. ANN'S HOSPITAL

DISTURBED WEIGHT IN INFANCY

THE nutritional diseases of infants is the most important chapter in pediatrics. Whether the baby lives depends in large measure on whether it thrives.

The most frequent disturbance met with is that the baby's weight does not progress upward satisfactorily. Everyone today is impressed with the necessity of carefully weighing the baby at regular intervals to see that there is a satisfactory gain. The baby at the breast the first five months gains with ease 1 ounce a day; not so often, however, the artificially fed infant. At the outset it must be emphasized that there is the greatest difference in the world in babies in their ability to gain weight and their tendency to develop such chronic nutritional disturbances as rickets.

Some infants thrive on almost any artificial mixture, and it would appear that they could scarcely do better. But there is a large army of infants whose weight is not satisfactory, whose turgor is subnormal, and pallor only too apparent. In looking over this vast group of babies we see that there are many factors at work. The milk mixture will naturally first receive our attention. In many cases it will be found that the mother and practitioner, in their endeavor to make the weight ascend, keep adding more milk to the formula. The crying and restlessness which are so often present in these babies is interpreted as hunger; at this point the constitution of the baby will play a part—the poorer the constitution, the lower will be the tolerance for cow's milk. It can be stated rather dogmatically that the baby never requires more than

1 quart of cow's milk in twenty-four hours. If this does not bring about improvement, then something else must be added to the diet. Most infants have their nitrogen requirements covered when they receive 1½ to 2 ounces of milk for every pound of body weight. Clinical experience teaches that many infants do very well when they receive as much as 1½ pints of milk in their mixture in twenty-four hours. It is an old observation that as the mother added more milk the weight descended. This phenomenon seems to depend on the fact that as the amount of fat in the food is increased, more and more magnesium and calcium are lost by the bowel in the stools, which influences the intermediary metabolism, depressing the weight curve.

We will now consider the group of babies that were doing well until some illness overtook them, since which time they cannot "get going." The weight curve is either stationery or is steadily declining. Any infection may be responsible for the sudden interruption in the progress of the baby; the more delicate and younger the baby, the easier the weight is disturbed and the milder the infection can be which is responsible. Here we meet with all possible infections of nose, throat, and respiratory apparatus which are so common—otitis, pyelitis, staphylococcus infections of the skin should be mentioned. As the result of the infant passing through the infection the food which previously caused a satisfactory gain in weight now utterly fails, and unless something is done the metabolism disturbance becomes deep rooted and the possibility of the development of marasmus is not any too distant.

The constitutionally disturbed child plays a large part in weight disturbance. The baby with exudative diathesis often causes us difficulty; the neurotic and hypertonic baby, with its almost ceaseless cry, does not grow very well. It must be definitely understood that the infants with weight disturbance are not being starved, but that they receive a sufficiency of food both for energy and growth; their digestion seems normal as judged by the appearance of the stool, the absence of vomiting, and in many instances not an unusual amount of restlessness. There is a defect in their intermediary metabolism; the tissue cells are unable to

grasp and hold on to the mineral matter and water carried by the body juices.

The examination of the stools has always been a fascinating study in our endeavor to benefit these nutritionally disturbed infants. A large number of these infants are constipated, an indication of excessive alkalinity of the intestines. The present-day pediatrician in such an instance will not resort to drugs to purge the baby, but will stop the putrefaction by the administration of an easily fermentable disaccharid. Again, in other instances the stools seem normal, bowels move once or twice a day, and nothing unusual is observed in this respect. These are the babies that have had their weight disturbed following an infection, or as the result of unhygienic surroundings—not enough airing, or as the result of a bad constitution. If diarrhea develops, the baby must be treated for its dyspepsia and, of course, the case is not one of a simple weight disturbance.

What measures, then, are we going to resort to to make the baby put on weight? If the weight is stationary over any length of time the baby is not well, and something must be done to restore it. More than ten years ago we departed from the conventional method of feeding infants, and began at an early age to feed starch. This was at a time when the practice was considered the rankest of heresies. Our brilliant results have proved in a clinical way that the fear of starch in the diet of an infant was unfounded. It is generally acknowledged to day that there is no etiologic relation between rickets and starch in the diet. Any damage that starch could bring about must be only on the digestive tract, with a consequent failure of the infant to thrive. We are not only able to prevent our babies from developing a weight disturbance, but we can cure them by this method if the metabolic disturbance is not too deep seated. This method is best adapted to infants after they have reached three months of age; however, younger infants at times do well on this; but it is quite experimental. Infants during the first two months, if they are not doing well, need some breast milk.

We have always been partial to lactic acid milk when there was any doubt in regard to the infant thriving. Langstein and

Meyer quote Koeppe to the effect that the sour milk contains more free ions which is one factor in the explanation of the favorable effect following this method of feeding.

To be a little more specific with the method we will go into more detail. The infant is ordered a milk mixture in which 1½ to 2 ounces of whole milk for every pound is furnished. This may be sweet or acidified. Then we know the nitrogen requirements will be met and that an excess of fat will not be fed. Then we add 30 grams of cane-sugar or the popular maltose and dextrin; this may be increased to 50 grams if the bowels do not loosen. Here is where we add our starch in the form of a thick cereal. Two tablespoons of cream of wheat or rice flour are cooked with 8 ounces of water one hour in a double boiler. This thick gruel is fed from a spoon once or twice a day before the milk feedings, beginning with a teaspoonful and increasing gradually to the amount directed above to be prepared. The rice flour is used if the bowels are inclined to be loose; the cream of wheat, if they are constipated. The large majority of our babies receive the cream of wheat. To feed an infant this thick cereal from a spoon requires considerable patience, as the infants frequently in the beginning either do not want to swallow or else spit the food out. We have fed hundreds of babies by this method, and we consider it so valuable that we could scarcely do without it. Nothing is said about calories for the reason that these infants for their age are so much under weight that their caloric requirement is 50 per cent. or more above the normal; we must forget about the energy quotient and continue to increase the twenty-four-hour amount of food until the weight goes up.

To illustrate what has been said above 2 cases from private practice will be cited. Baby H., first seen at four and one-half months of age, weight 9½ pounds, birth weight 8 pounds. It had received a number of different mixtures in its short period of existence. Constipation was very pronounced, and it was necessary for the mother to resort to an enema or purgative daily to get a stool. Top-milk mixtures figured prominently in the diet. The weight curve ran a zigzag course, with really very little progress being made. The baby was restless, slept poorly, and seemed

hungry all the time; it took all the food offered. A quart mixture was ordered with the usual twenty-four-hour amount of whole milk, to which 40 grams of maltose and dextrin were added. Later this was increased to 60 grams, as the bowels were still costive. Thick cream of wheat was started twice a day before the milk feedings, which was gradually increased to a cupful in twenty-four hours. After six weeks the infant had gained 2 pounds and the bowels were moving naturally.

Baby G. had done well on artificial feeding until four months of age; it then contracted a severe case of grip, which lasted three weeks. There was a loss of $2\frac{1}{2}$ pounds, the weight falling to 10 pounds. The next four weeks the weight was stationary in spite of the fact that there were liberal feedings. Cream of wheat was started, which caused a sharp rise in the weight curve, with a return of the baby to normal nutrition.

In conclusion, we wish to say that the number of infants whose weight will not progress satisfactorily is steadily growing smaller. Progress is being made, and while every infant is entitled to breast milk, the number which perish for the lack of it is certainly on the decline.

CLINIC OF DR. P. C. JEANS

ST. LOUIS CHILDREN'S HOSPITAL

TREATMENT OF HEREDITARY SYPHILIS

THIS patient before you is now nine years old. She first came under observation at the age of four years because of failing vision. In fact, by the time she was seen by us the vision had failed completely. On examination, there was found bilaterally a complete optic atrophy. Aside from unequal and fixed pupils no other abnormalities of interest were noted. The blood-serum gave a strongly positive Wassermann reaction. The cerebrospinal fluid showed slight opalescence and had a cell count of 234. Globulin was increased and a gold chlorid test gave the type of reduction known as a paretic curve. The Wassermann reaction was strongly positive. She was treated according to our present routine, which I will describe in a few moments, for a period of two and a half years. In her case the treatment included two admissions to the hospital for courses of intraspinal treatment, which consisted of intraspinal injections of mercurialized serum containing the equivalent of 1.2 mg. ($\frac{1}{50}$ grain) of mercury bichlorid to the injection. Since the cessation of treatment she has been under observation for two years, during which time the Wassermann reaction of both the blood and cerebrospinal fluid has been negative at all examinations and she herself has been free from clinical manifestations of the disease. The treatment, of course, had not the slightest effect upon the optic atrophy and she is permanently blind, but in every other way we would consider her as having been cured of her infection. This girl, selected from many somewhat similar cases, is shown as an example of what we consider a cure of syphilis, and to emphasize the fact that persistence and moderately intensive treatment will usually result in cure.

The impression commonly prevails that hereditary syphilis is difficult or impossible to cure. This was also our impression from our earlier experiences in treatment. Formerly it was our custom to prescribe gray powder three times daily in doses proportionate to the age of the child, and occasionally and rather unsystematically neo-arsphenamine was administered. In some instances inunctions of blue ointment were used for a time. All patients were carefully watched over by special social workers to see that the treatment was properly carried out at home. Under such a régime we not uncommonly brought about a persistently negative Wassermann reaction in the case of infants and very young children, but this occurred rarely in the case of the older children. The treatment these children received we believe was just as thorough and intensive as is now ordinarily given to children, and for a time we were satisfied with it. Following in the footsteps of those who treat adult syphilitics in the approved modern fashion, we gradually made the treatment more systematic and somewhat more intensive. No doubt the present methods of treatment can be and will be greatly improved, but by their use we believe that every syphilitic child can be cured according to our present standards of cure.

Our present methods are as follows: The child attends the clinic once a week. At each visit 0.03 c.c. ($\frac{1}{2}$ minim) of a 1 per cent. solution of mercury bichlorid for each kilo (2.2 pounds) of body weight is injected intramuscularly. Gray powder is prescribed three times daily in doses ranging from 12 mg. ($\frac{1}{5}$ grain) for infants to 120 mg. (2 grains) for large children. A laxative effect is avoided. Every two months is given a course of three weekly intravenous injections of arsphenamine in the dose of .01 gm. per kilo. A rest of four to eight weeks is given each year, provided such a vacation has not been forfeited by irregular attendance. Iodids are seldom used. The minimum duration of treatment is one year for infants and two years in the case of older children, regardless of what the Wassermann reaction shows. The treatment as here outlined is all that is given except in certain cases with central nervous system involvement. It is our practice to examine the cerebrospinal fluid routinely in every case at

the beginning of treatment. Such examination has shown that approximately one-third of all luetic children have at least strong laboratory evidence of nervous system involvement. The neurosyphilis usually is found to respond satisfactorily in the case of most infants and some older children to the treatment as just outlined. In others the response is slow, and in such cases we have routinely resorted to intraspinal treatment. We have tried the various methods of intraspinal therapy that have been advocated, even including that of Ravaut—the administration of neo-arsphenamine solution directly into the spinal canal. At present we routinely use the Swift-Ellis method, as it seems to us best to meet our needs. According to this method blood is withdrawn one-half hour after intravenous arsphenamine, allowed to clot, and the serum separated. The serum is inactivated for one-half hour at 56° C. According to the size of the child from 10 to 30 c.c. are then injected slowly by gravity into the spinal canal, first having removed an equivalent or greater amount of cerebrospinal fluid. The interval between the intraspinal injections varies with the amount of reaction to them. Ordinarily they can be given once a week with safety and in some cases every four or five days. It is highly desirable to have the patient hospitalized during this period; in fact, we would refuse to give it otherwise. Three doses usually constitute a course, though sometimes more are given. The courses may be repeated every two or three months. It is usually best to have the interval between the intravenous and intraspinous treatment as short as possible. This is facilitated by using at one treatment serum which was obtained at a previous treatment a few days before.

Nothing new in the treatment of syphilis is here advocated, but rather is it meant to point out that children can be treated by the accepted methods of treating adults not only with safety but to advantage. Certain exceptions to these rules are to be noted. When starting treatment in infants with florid syphilis it is wise to use smaller doses of arsphenamine. Full doses of arsphenamine at this time may result in the death of the infant. We also consider the infant's progress in nutrition of greater importance than antisyphilitic treatment to the extent that treatment

is stopped entirely or small dosages given if the more intensive treatment seems to interfere with the nutrition, as it often does at first. When more intensive treatment is desired the mercury injections are given three times a week and the gray powder discontinued. Also arsphenamine is given at forty-eight-hour intervals. A twenty-four-hour interval is proving safe for adults and will doubtless prove equally safe for children. Such an interval is rational on theoretic grounds. Though a more intensive treatment than the one we routinely use probably would be advantageous to the patient, we have felt that it would be difficult to get sufficient co-operation for attendance more than once a week over so long a period. It is possible that we are mistaken in this opinion.

Many hesitate to give intramuscular injections of mercury to children, and we also were in doubt as to its feasibility at first. A long experience with this method, however, has shown that there is but little objection to it, and the objections are outweighed by the advantages. A dispensary patient is more likely to continue to take pills than use inunctions, but even pills are so frequently forgotten or taken irregularly that their use is unsatisfactory for this reason. If the patients are compelled to attend regularly and injections given there is at least the satisfaction of knowing certainly that the patient is receiving mercury. For such injections it is our opinion that the bichlorid is the most satisfactory of the preparations in common use, though this salt is not without disadvantages. In some patients the injections are painful and the pain may continue for minutes or even an hour or two. Not infrequently at the site of injection nodules of induration form, which persist for days or weeks. There doubtless occurs a certain amount of muscle destruction as a result of the injection. Though these events are unpleasant, they are not serious enough to warrant the discontinuance of injections. Perhaps further investigation will disclose a more satisfactory preparation of mercury for injection which will be free from these objections.

Whether or not the intraspinal treatment of neurosyphilis is rational is still a disputed and unsettled question. Mercury does

not reach the cerebrospinal fluid in detectable amounts, and the amount of arsphenamine which may be found in the fluid is small. Certain important questions have not been answered. Does arsphenamine ever penetrate to the cerebrospinal fluid, or can it be injected there without damage in sufficient amount to constitute an effective concentration against the spirochete? Is the presence of either mercury or arsphenamine in the cerebrospinal fluid desirable or necessary for the control of any case of neurosyphilis? These questions at present find their answer largely in clinical experience rather than in theoretic considerations or laboratory data. It is now certain that when properly carried out intraspinal treatment has no harmful effect upon the patient except occasional temporary reactions of no serious consequence. We have resorted to this method of treatment only when several months of other treatment has been without apparent effect. Our opinion based upon clinical experience is that the desired result is more quickly obtained when intraspinal treatment is used than when it is not.

CLINIC OF DR. HORACE W. SOPER

CLINICAL TYPES OF CHRONIC CONSTIPATION

THE researches of Rosenheim, Holzknecht, Case, Cannon, Hurst, and others in the physiology of defecation has enabled us to place the treatment of this condition on a rational basis. W. H. Mayo has made a careful study of the anatomy of the rectosigmoid apparatus, and has pointed out the analogy existing between it and the cardia or pylorus.

The rectosigmoid has the same arrangement of circular muscle-fibers and a similar nerve supply. Hurst designates this region as the rectosigmoid angle, and has shown that it performs an important function in regulating the time of the act of defecation. It appears that the rectosigmoid apparatus holds up the column of feces and prevents it from entering the rectum until the proper time for defecation has arrived. At this time the muscle-fibers relax and permit fecal matter to enter the rectum. The weight of the feces excite the "muscle sense reflex," causing expulsion of the rectal contents. This procedure is repeated until, as Hurst has shown, the normal adult doing active muscular work will completely empty the colon from the splenic flexure to the anus.

It must be emphasized that at all other times the rectum is free from fecal matter. Under normal conditions but one such passage should occur daily; after the act of defecation it requires about twenty-four hours' time for the fecal column to reach the rectopelvic junction. About thirty-three hours' time is required for a meal to be entirely evacuated from the gastro-intestinal tract. Food taken nine hours before the act of defecation should reach the splenic flexure and part of it appear in the feces. These figures (Hurst) represent the time required for the average healthy individual at active muscular work. Modifications

must, of course, be made for the asthenic type, who habitually have a slower rate of gastro-intestinal motility, as well as the hyperasthenic type, whose motility is higher than the average normal, as pointed out by Mills in his work on Habitus.

While the *x*-ray is the best means by which to determine colonic motility, simpler tests are available—*e. g.*, a 5-grain carmin or charcoal capsule given with the evening meal should appear (traces at least) in the feces evacuated the following morning. No trace of the carmin or charcoal should be present on the third morning—*i. e.*, sixty hours after the ingestion of the capsule.

The first group of patients which I wish to consider belong to the class that I have designated ***simple, uncomplicated constipation***. My cases' records show that this class is by far the largest one of all, representing about 50 per cent. of constipation from all causes. After a thorough study of such cases, including the *x*-ray of the gastro-intestinal tract, feces analysis, and proctosigmoidoscopy, we find no evidence of organic trouble; in other words, the mechanism necessary for the production of normal colonic function is intact, but through neglect and abuse it has become ineffective. These cases give a history of constipation lasting all the way from one to twenty-five years. The manner in which the constipation has been produced is in all cases practically the same.

After each period of defecation the patient hurriedly empties the rectum only, the descending and iliac colon remaining full of fecal matter; the rectosigmoid apparatus again relaxes, permiting the feces to enter the rectum, producing call for defecation. This is unheeded until finally the "muscle sense of the rectum" is lost and the patient resorts to the use of purgatives and enemata.

TREATMENT

The patient must be instructed in the rudiments of colonic physiology; enemata and all purgatives must be stopped at once. The fecal column must be permitted to form in the lower colon. It will require from three to four days for this restoration to occur; during this time patients who are apprehensive of disaster

must be reassured. Nothing will happen even if the bowels should not act. On the third day the sphincter should be dilated or, preferably, the proptosigmoidoscope introduced. The passage of the instrument usually excites enough stimulation to cause a passage. We have employed a form of colonic pressure which is valuable in aiding the patient to secure a complete evacuation. The procedure is as follows:

The patient should lean forward in the defecation posture, with the abdominal muscles relaxed, and make deep steady pressure directly under the ribs deep in the costal angle on each side of the epigastrium. In all probability the benefit secured by such pressure is caused by a stimulation of the nervous mechanism of the colon; furthermore, the patient is instructed to drink a pint of cold water upon arising, followed immediately by fifteen minutes of active muscular exercises directed toward the abdominal muscles; after breakfast he must make an attempt at defecation, allowing at least fifteen minutes' time for the act. The diet must be generous, especially rich in vegetables and fruits. Agar-agar is always helpful, inasmuch as it prevents too much drying of the feces and, furthermore, facilitates the passage along the colonic wall.

The restoration of colonic function adds much to the well-being and health of such individuals; the time required is from four to six weeks. It is remarkable that the colon will undergo such abuse without developing any pathologic lesions or suffer any serious crippling of the neuromuscular mechanism. Many persons not of nervous temperament and not introspective have taken the discomfort produced by daily purgatives as a matter of course. This attitude is encouraged by some physicians who, regardless of the teachings of modern physiology, still think of the human colon as a sewer that should be kept flushed out—possibly a relic of the old humoralistic theory of pathology.

I have considered above the cases of *simple, uncomplicated constipation, i. e.*, those who have been fortunate enough to escape serious damage; there remains a large percentage who are unquestionably damaged by the daily use of purgatives and enemata. They may be grouped as follows:

Group I. Sphincter spasm and rectal contractures.
Group II. Spastic contractures of the rectosigmoid region and spasm of the iliac colon.
Group III. Pus infections of the rectum and rectosigmoid region.
Group IV. Atony of the rectum and sigmoid.

SPHINCTER SPASM AND RECTAL CONTRACTURES

In cases of this character the sphincter muscle is very tight and resists the introduction of the finger or instrumentation. Inspection of the mucous membrane of the anal canal reveals the presence of a mild inflammatory process; no break in the membrane, such as ulcers or fissures, are present. The entire rectum is contracted and resists the passage of the proctoscope. The rectal mucosa is deep red and congested; some mucus and fragments of fecal matter are found in the folds. The patient complains of tenesmus and gives a history of several small ineffectual daily passages. Treatment consists of dilatations of the sphincter and rectum by means of graduated proctoscopes. The patient must be given the same instructions for the restoration of colonic function as considered above in the treatment of *simple, uncomplicated constipation.*

SPASTIC CONTRACTURE OF THE RECTOSIGMOID REGION AND SPASM OF THE ILIAC COLON

These two conditions are often present simultaneously in the same patient; however, they may exist independent of each other.

Spastic contracture of the rectosigmoid region produces a definite syndrome, which I have designated as "sigmoidospasm." The patient gives a history of ever-increasing difficulty in obtaining a bowel movement. The passage is usually accompanied by pain in the left groin. The feces are fragmentary in character, consisting chiefly of small hard "marbles." Enemata of water are introduced with difficulty and often produce severe colic. Sigmoidoscopy reveals the presence of a very tight contracture at the rectosigmoid angle. It is impossible to get the smallest size tube through it; it even resists the pressure of the cotton

applicator. Sometimes it is possible to pass through the small oiled applicator. Under normal conditions this region relaxes and finally permits the passage of the tube.

As I have shown elsewhere solutions of magnesium sulphate applied directly to this area act as a specific in overcoming the hypertonicity of the circular muscle-fibers of the rectosigmoid apparatus. The cotton applicator is moistened by a saturated solution of magnesium sulphate made directly to the spastic area. Treatment is repeated every second or third day until the spasm finally relaxes and function is restored.

Spasm of the iliac colon can be detected by means of palpation. Under normal conditions the iliac colon can be felt as a rather small cord, but it will alternately contract and relax under the palpating fingers. In atony of the iliac colon no contracture can be felt. In chronic spasm of the iliac colon it can be palpated as a rigid unyielding cord usually tender to pressure. Inasmuch as it is impossible to reach the iliac colon by the sigmoidoscope in most cases, resort is made to the following procedure:

The patient is placed in the knee-chest posture and the sigmoidoscope introduced as far as possible, a well-lubricated soft-rubber catheter is passed through the tube, and from 1 to 2 ounces of a saturated solution of magnesium sulphate injected by means of a piston syringe. The sigmoidoscope and catheter are withdrawn, the patient remaining in the knee-chest posture for at least five minutes' time. These treatments are continued until the spasm relaxes. The patient must, of course, make the same efforts to restore colonic function as described above in the treatment of *simple, uncomplicated constipation.*

The results of specific treatment in these cases are brilliant and permanent. Temporary relapses may occur in neurotic patients and in those who are obliged to travel and are thus unable to follow their usual mode of living.

In my opinion purgatives and the use of enemata are equally to blame for the production of the spastic contractures in this region of the bowel.

PUS INFECTIONS OF THE RECTOSIGMOID REGIONS

The rectum and sigmoid are especially likely to be invaded by the pyogenic micro-organisms, particularly the streptococcus, staphylococcus, and several forms of diplococcus. In many cases the origin of the trouble is difficult to ascertain, but I am convinced that the water enema is responsible for many of the infections; it is probably introduced by the enema tube. Cases present themselves with varying degrees of infection, ranging from mild granular proctitis to severe ulceration of the entire mucous membrane. The average case shows small ulcers here and there in the mucosa, which is covered with mucopurulent material. Cultures are made directly through the sigmoidoscopic tube by means of sterilized cotton applicators. Patients, as a rule, complain of diarrhea, but investigation of the case will usually show that the daily amount of evacuated feces is quite small, most of the passage being formed of pus and mucus. Curiously enough severe forms of pus infection limited to the rectum and sigmoid often produce a definite stasis higher up in the colon. One of our cases who had a severe form of pus proctosigmoiditis of ten years' duration showed an *x*-ray stasis in the transverse colon which persisted for one week; in this case the infectious agent was in all probability introduced by the enema tube which had been in daily use throughout the typhoid infection.

Treatment of these infections consists in daily insufflations of a powder introduced through the sigmoidoscopic tube by means of a powder-blower. The powder most efficacious consists of equal parts of bismuth subcarbonate and calomel. As I have previously pointed out calomel is free from danger and is non-irritant, and is the best antiseptic of all available powders; furthermore, it clings close to the mucous membrane "like the frosting on a cake." This method of using powder insufflations was first advised by Rosenburg and has not met with the recognition it deserves. It is far superior to all sorts of washes and liquid solutions; moreover, liquid solutions are dangerous, inasmuch as they may carry infection higher up into the bowel and change a curable proctitis into an incurable chronic *colitis*. Autogenous

vaccine should be used in every case; however, chief reliance should be placed on local treatment.

ATONY OF THE RECTOSIGMOID

Atonic conditions limited to the rectum and sigmoid have, I believe, been often erroneously attributed to the use of water enemata; in my experience such is not the case. A majority of the enema users show more often spastic conditions and infectious process in the mucosa rather than atony. In all probability this assumption was produced by the fact that patients who suffer from atony of this region are forced to resort to the water enema as the only effective means at their disposal. When the rectum alone is involved in the atonic process Hurst designates it by the term "dyschezia." In my opinion the condition is produced in normal individuals by the habit formed of permitting the rectum to remain full of fecal matter.

Treatment may be successful in mild cases, but in the severer ones little can be done. The most successful method that I have found is by following the physiologic principles as above described; by regular dilatations of the sphincter and by digital emptying of the rectum.

There remains a class of cases in which the rectosigmoid apparatus has lost its power of contraction. In some few cases this condition is acquired by permitting large masses of fecal matter to remain in the lower bowel for prolonged periods, particularly in cases of ulcer involving the anal canal. In the majority of cases, however, I believe the condition is congenital or has been acquired in early infancy, in much the same way that Hirschsprung's disease is originated. Sigmoidoscopy shows no line of demarcation between the rectum and sigmoid; all tendency to contracture is lost, the resulting constipation being exceedingly obstinate. No treatment is effectual except the use of large enemata of water.

In the presentation of these cases I have purposely emphasized the rôle which defects in the lower colon play in the production of chronic constipation. Many of these patients suffer from the symptom-complex which we may justly attribute to "auto-intoxication." We may assume that obstructive ele-

ments in the lower bowel lead to a slowing up all along the line and cause aberrant biochemical changes which are concerned in the production of symptoms usually termed "auto-intoxication." At any rate, it is true that after the restoration of colonic function these symptoms disappear in a large majority of cases.

In my opinion we are justified in the conclusion that the best treatment, both prophylactic and curative, consists in the observance of the laws that underlie physiologic defecation.

CLINIC OF DR. LLEWELLYN SALE

ST. LOUIS CITY HOSPITAL

PRESENTATION OF A CASE OF PAROXYSMAL TACHYCARDIA

THE patient whose case we shall discuss this morning is a young married woman thirty-five years of age. She was admitted to the hospital last night and gave the following history: Ten days ago she went to an exodontist, who removed a tooth that her dentist had condemned. The extraction was done under gas-oxygen anesthesia and was attended by no unusual circumstances. The patient went home and busied herself about her routine household affairs. Several hours later she felt weak and laid down. She had no pain. The feeling of weakness came on rather suddenly. For the next ten days she continued to feel weak and had at times a sense of precordial oppression that hampered her respiration slightly, and occasionally a "fluttering feeling in the chest." At times she would break out in a cold sweat. This was the history obtained by me last night at 9 P. M. when I saw her at her home. Her condition then presented all the features that it does now except that she has now an annoying nausea and vomits whenever she takes food or drink.

Before we examine the patient let me tell you something of her history. There is nothing significant in her family history. Nineteen years ago she had pneumonia, and since then has been subject to asthmatic attacks. These come on six or eight times a year, are not very severe, show no seasonal variations, but occur when the air is "damp and heavy." Nine years ago she consulted one of our leading internists because of "stomach

trouble," *i. e.*, distress in epigastrium after eating. Her then physician made a diagnosis of enteroptosis, a diagnosis that was very popular in those days. Since then she has had attacks of upper abdominal pain off and on. In Februrary of this year I saw her, and concluded she had gall-stones, told her so, and advised operation. She has been married fifteen years, has 5 healthy children, her husband is well, and she has had no miscarriages. She has never had a tooth extracted before, but she has had chloroform administered with her pregnancies.

There is no history of "rheumatism" or chorea. There have been no recurrent attacks of tonsillitis, but about five years ago patient had a peritonsillar abscess. She has been seen by several physicians during the last ten years, and has never been told that she has anything the matter with her heart.

You see before you a rather frail woman with some pallor of the skin and visible mucous membranes. Her expression is anxious, and she is breathing about 35 times a minute. Her pupils are equal and react to light. Her teeth and gums are apparently in good condition. Her pharynx is negative. There is no pulsation in the neck, but the neck veins are full. The thyroid is not enlarged. Lungs are negative, and it is especially noteworthy that no râles can be heard. The apex impulse is not visible or palpable and there are no thrills or pulsations. Her pulse is very rapid and regular, so rapid, in fact, that you doubt your ability to count it accurately at the wrist, and determine to do so with your stethoscope. You are able to count 92 beats for each half-minute. You are struck by the fact that the rhythm is quite regular. When you outline the area of cardiac dulness you see that the heart is not enlarged, the left border is only 9 cm. from the midsternal line. The right border extends to the right parasternal line. The sounds are clear, neither unusually faint nor unusually loud. The rest of the examination can be rehearsed with you quickly. Liver and spleen are not enlarged. There are no abdominal masses and no tenderness, not even in the gall-bladder region. The knee kicks are active and equal. There is no edema. The hands and feet are cool and there is no cyanosis.

These electrocardiograms were made last night about an hour after the patient was admitted to the hospital. You can see that the rate is very rapid—187 per minute—and that the rhythm is quite regular. The Q. R. S. group is normal in contour and time. The P and T waves cannot be definitely identified. The T wave is rather high, and this is probably due to a superior imposition of the T and P waves. In Lead I you can see a slight bulge in the T wave that may be due to auricular activity. If the P wave were not normal, or very nearly so, we would expect to find some evidence of it instead of merely an increased T wave. The auricular impulse arises then very near the sino-auricular node, perhaps in the node itself.

This, then, is a case of tachycardia coming on suddenly following extraction of a tooth. It has lasted now for ten days, and is apparently the first time the patient has had such an attack. It is a paroxysmal tachycardia, and this is the first paroxysm. In paroxysmal tachycardia the normal cardiac mechanism is disturbed, and there are rapid contractions of the muscle due to rhythmic and pathologic impulses. The dividing line between paroxysmal tachycardia and auricular flutter cannot be rigidly drawn at the present time. In flutter the rate is usually higher than it is in this case, and it is quite common to find that a partial heart-block exists. Here we have nothing of the sort. The P wave cannot be studied in these tracings, and we get no exact information as to the site of origin of the impulse.

When the patient was admitted to the hospital she was given morphin, digitalis, and an ice-bag to the precordium. Change of position and vagus pressure have had no effect on the rate. She has been very restless, and proctoclysis, which was attempted this morning, could not be continued. We are getting ready now to give her saline subdermally. She is vomiting now, and we shall give her digalen in large doses hypodermically to try to produce a partial block, so that the ventricles may get enough rest to lessen the gravity of the situation.

We have, then, to summarize, a case of tachycardia, paroxysmal in type, in a woman who has never had heart disease of any sort. It has lasted now for ten days and the symptoms have

grown progressively worse. The tachycardia is auricular in origin. This is not a case of flutter. In auricular flutter the auricles contract so rapidly that the ventricles cannot keep pace, and we get auricular contractions to which there is no ventricular response.

As to the cause of this attack I can offer no explanation. There is a temptation to try to establish some connection between it and the anesthesia and tooth extraction. To say that the gas was toxic for this patient, and set up an irritable focus in the auricular wall from which the pathologic impulses originated, is mere speculation.

We shall continue with the administration of digitalis and morphin and with our proctoclysis or hypodermoclysis. If conditions permit, I shall present our patient to you next week again.

Twenty-four hours later the patient died. Her restlessness increased, her pulse-rate did not vary, and she developed no edema or cyanosis. Her respirations increased in rate (up to 45 per minute), and a few hours before death she had crackling râles at both bases.

Permission for an autopsy could not be obtained.

CLINIC OF DR. SIDNEY I. SCHWAB

BARNES HOSPITAL

FIVE CASES FROM THE NEUROLOGIC CLINIC OF BARNES HOSPITAL

THE cases to be demonstrated today are collected from the neurologic material in Barnes Hospital to show the connection between definite pathologic processes in the brain and the cerebral response in terms of mental symptoms. As a contrasting picture 2 cases will be shown in which the cerebral response, though striking and even dramatic, is not produced through changes in the brain tissue demonstrable by any of the well-recognized procedures now available, but by mechanism through which the orderly workings of consciousness are at fault, caused through changes in the organism of which at the present time we are but dimly aware. For the purpose of this illustration the following will be shown:

I. A case of paresis.
II. A case of postmeningitic dementia.
III. A case of frontal lobe tumor.
IV. A case of dementia præcox.
V. A case of manic-depressive psychosis.

Such a demonstration should provide an opportunity not only for clinical comparison but also for the consideration of a number of interesting and important questions arising out of the study of mental cases in the wards of a general hospital. The great advantage that comes from the attempted approach to the problems presented by mental illness through the ordinary clinical neurologic channels will in this way be emphasized. I mean by this simply that an individual who presents symptoms that call for the diagnosis of insanity is, first of all, a sick person,

and as such is entitled to all the considerations that are commonly given to one so handicapped. The first duty of his physician is to see that there is placed at his disposal all that medicine has to offer in the way of diagnosis and treatnent. After this is done the legal and civil phase of the problem may be taken up, and removal from his social environment, if that becomes necessary, is in a sense an additional medical duty based upon the conduct deviations that happen to be present. I desire in this way to separate out the custodial and medical aspects of the problems presented by mental diseases, and to sharply differentiate the hospital from the usual institutional attitude to which many such cases are necessarily so often subjected. There is not implied in this idea any criticism toward custodial measures. In many instances they are very necessary, but before they are planned and carried out every possible abnormality that can in any way be brought into the causation of symptoms must not only be inquired into, but must become the object of serious therapeutic endeavor. At the present time in this community such an effort can only be carried out in the wards and through the clinical organization which is found in a general hospital of the type represented by the Barnes Hospital.

You will note, I hope, after the presentation of this series of cases that one of them has a way opened through surgery for restoration to the normal; another may respond to energetic treatment in a way compatible to orderly social contact with his environment; and a third may be carried through an episode of abnormal mentality into a free interval; and that a fourth and fifth may by intelligently directed corrective and adaptative efforts regain their former social positions. I feel sure that under less advantageous medical surroundings all 5 of these cases might very well be by now segregated in some institution for the care of the insane, where they would be lost to intensive study through the lack of adequate personnel and of proper medical and laboratory equipment. It is therefore proper to emphasize here that every case of insanity presents a medical and social phase with its legal and custodial elements. The community is too ready to place its effort on the latter, very often to the exclusion

of the former. It becomes, therefore, the duty of physicians who are concerned in cases of this kind—and each one of you will be concerned in some degree at least—to make every effort to shift the emphasis in the direction which will tend to the betterment of those unfortunates who become the subject of mental illness.

CASE I.—PARESIS

This is a case of paresis in a young unmarried man thirty years of age, who was discharged from the army on the discovery that he showed evidence of mental disease which was presumably due to syphilis. There are no pertinent factors either in his family history or personal history as far as heredity or acute diseases are concerned with the exception of a gonorrheal infection in 1910 and an infection of syphilis later in the same year. For the latter he was treated with one dose of salvarsan and discharged by his doctor as cured. Up to the time of the development of symptoms of a nervous sort no important medical anomalies were observed in this case. In the year or two preceding the outbreak of his present condition there were certain conduct deviations of which there is at present very little definite information. This man was an insurance solicitor, and while persuing this business he became unfortunately involved with a married women, and this led to his leaving the job. He then sold tea and coffee in Kansas, alternating from time to time with his former work as insurance solicitor. He entered the army in 1918, but it was soon apparent to his superior officers that he could only carry out light duty. He was nervous and inattentive and it was noticed that he learned the elements of soldiery with the greatest of difficulty. As far as the patient himself was concerned he was not conscious of any such failing in his capacity for soldiering. His officer, however, noted that he could not learn to drill correctly and that he was always making mistakes. In January, 1919 he was discharged from the army. Following his discharge he had a variety of positions, in none of which he was successful. He had a railroad job and held it for only one month; then he was with a silk company for four months; then he had another railroad job, and was discharged from this. In each case the reason

for his discharge was that he made mistakes and could not seem to understand what was required of him. Here, again, the patient was unaware of his mental failing and was prone to regard his dismissals as due to bad luck or some circumstance over which he had no control. Since January, 1920 the patient has not worked. He has received three intraspinal salvarsan treatments at the advice of a physician who found his blood showed a positive Wassermann. In January, 1920 he entered the Public Health Hospital for treatment, but stayed there only a few days, and on July 13th he became a patient at the Barnes Hospital. On entrance it was noted that he presented a rather dull and vacant appearance, but showed no gross physical defects, and upon examination nothing of a general nature was found. Neurologically he showed among other things an Argyll Robertson pupil, absent knee- and Achilles' jerks. It was noted that his expression and speech seemed to be typical of paresis, he spoke in a low voice with uncertain vocalization. He was found to possess a fair degree of insight into his own condition and seemed able to grasp the significance of its relation to syphilis. He described his chief complaint as inability to think. At the time of his first examination his P. S. P. test was normal. Spinal fluid showed 45 lymphocytes; blood and spinal fluid showed 4 plus to all antigens, and there was a typical paretic curve. The mental tests and the analyses of his behavior reactions showed a mental age of about twelve years. The total score is very low for a college graduate, giving 78 instead of 92, or 94 by the scale point test. This shows, of course, a marked deterioration. The mental processes are confused, answers are given slowly, and there is a very marked memory defect. Attention is fairly good, but association is very poor. There is a good deal of scattering, the higher test being passed more easily than the lower. The judgment defect is slight, so that it is probable that his inability to hold a place for any length of time is due rather to poor memory than poor judgment. Various tests showed patient's inability to do any actual work and do it correctly and accurately.

The widely differing picture presented by this case as com-

pared to that found in the usual text-book descriptions is of interest. Here there is no definite tendency toward the formation of grandiose ideas and no impulse to act in the line of such ideas. There are no extravagant and foolish conduct manifestations and no outbreaks of acute excitement. The patient has, however, been through a series of attacks in which slight convulsions were present, with rise of temperature, temporary paralysis, complete speech defect, and total disorientation. These are among the most characteristic features of paresis and are called paretic attacks. From the standpoint of behavior, which is, after all, the most important diagnostic criterion of any mental disease, this patient shows what may be described as a steadily narrowing behavior field. This tends more and more persistently to his elimination as a unit in social activity of any kind. It is, in short, a picture of a general decrease in intellectual capital through a quantitative lessening in all the components that make up the assets of consciousness. The lack of delusional formation may very well have something to do with the general and proportional decline in general intelligence, as well as the accompanying lessened degree of emotional response. It is this leveling down of the mass of intelligence assets that is the most striking characteristic of this particular case of paresis.

The diagnosis of paresis, rather than that of a cerebrospinal syphilis or cortical syphilis, is made because of the typical findings in the nervous system, together with the progressive mental alteration. These and the serologic findings with the special emphasis on the characteristic paretic curve leaves the diagnosis unquestioned. Certainly there can be no doubt about the active participation of the spirochetes in the cerebral process which is here present. Call this condition paresis or what you will, it corresponds to everything that is supposed to underly the paretic manifestations clinically as a reaction to a syphilitic meningo-encephalitic process.

The therapeutic problem rests, then, upon the conception of the sort of pathologic process present. If there is a total central process in the sense of Head, involving the cells of the cortex alone, and if the degenerative reaction has set in to the total

exclusion of the meninges and the vascular cortical system, then any therapeutic attempt is bound to fail. There is no known therapeutic means that will in any way influence a primary neurotic degeneration. From what is known, however, of the pathogenesis of paresis there is present a reaction to the spirochetal nests found in the cortex. It must be assumed that in some stage of this reaction or preceding it a meningovascular process results, which tends to infiltrate the cortex following the model seen in a cortical syphilis. It is this adventitious inflammatory reaction accompanying the paretic cortical change that provides the opportunity for active therapy. Before the paretic change takes place there is a preceding stage in which the active participation of the meninges themselves is present, and, in fact, there is probably no stage of a developing paresis in which this process is not there to some extent at least. No stage, that is, unless the final phase of complete degeneration with cortical atrophy as a result. The stationary paretic from the pathologic point of view is that stage in which there is no active meningeal reaction present, or when the clinical picture is completely cast in the mold of the symptoms arising from a cortical degeneration. This stage in tabes is reached when the spinal fluid is cleared from lymphocytic increase and when the reaction to Wassermann tests in both blood and fluid becomes negative. Syphilis as a factor in the progress of symptoms has disappeared, but the degeneration in the sensory neuron system keeps steadily on. In paresis the condition is evidently very much more complicated, perhaps owing to the more complicated anatomic elements involved and on account of the more intricate vascular relations, and also perhaps from the fact that in the brain there are isolated spirochetal foci, each of them, it might be supposed, in a different state of activity. At any rate, this case, both in its clinical aspect and in the evidence of an active meningeal process, is selected for intensive treatment. He has received, therefore, the following in the course of his several stays at this hospital: Forty-two intramuscular injections of mercury, seven intravenous injections of salvarsan, five intradural injections of salvarsan, and three intradural injections of mercury. These have all

been carefully controlled and given according to the plan that is being worked out in this clinic for cases of neurosyphilis. The result of all this is the reduction in cell count from 62 to 13, with no effect up to the present time upon the blood or fluid Wassermann. Various changes in the curve in the fluid has followed, but it is not possible now to interpret them properly. It is certainly not possible to deduce from the change of a paretic to a syphilitic curve that the process has likewise altered to that of a cerebrospinal syphilis of a meningovascular type. The patient is said to be improving if the testimony of his family and friends are to be believed. The patient himself presents little alteration, certainly not in the essential symptoms upon which the diagnosis of paresis was based. He is able to fulfil at the present time such minimal social duties as his deterioration permits. He is still a subject for further and continuous treatment. I desire to emphasize, however, not the therapeutic side of this case, but the change in personality, the conduct deviations, the decline in mental assets, the circumscription of the intellectual horizon produced by lesions of the total cortex with special frontal lobe localization in cases of a syphilitic meningo-encephalitis—called clinically paresis.

CASE II.—POSTMENINGITIC DEMENTIA

This case will be presented briefly simply to illustrate another kind of dementing process which followed a wide-spread meningitic process of an infectious nature. Here again it is the cerebral reaction in terms of mental symptoms that is of interest. Here the change is permanent, the condition, if anything, progressive, and no evidence of an acute reaction is found. Treatment, therefore, is not based upon any of the chemical therapeutic procedures, but is socially planned in the way of adaptation and adjustment.

This patient is forty-five years old, married, with two normal children of good intelligence. His chief presenting symptoms are certain degrees of mental dulness, lack of initiative, loss of memory, and a striking general decline in what may be described as general ability. Associated with these and indirectly due to them

is a change in personality in which irritability, loss of consideration for others, and sudden emotional outbursts are important items. Up to seven years ago this man was a vigorous, active, efficient worker, a shoemaker, who by virtue of hard and persistent endeavor had become foreman of the shop in which be began as an ordinary hand. To accomplish this he possessed qualities which are lacking in his make-up at the present time. He was then energetic, had a good memory, was self-controlled, punctual, and somewhat conciliatory—all things that are essential in positions of authority and control. No one of these does he possess today. Seven years ago he became acutely ill and soon after reached a condition in which profound disturbance in consciousness, high fever, delirium, and temporary paralysis were present. The patient remembers no fact in this experience except a vague detail of some operation on his spine, after which, as he puts it, he woke up. This was evidently a spinal puncture. He was said at that time to have been suffering from meningitis. Such was the diagnosis furnished by his physician, and, as far as can be ascertained, this was accurate. When he recovered after a prolonged convalescence the mental change that has been briefly described was present and has continued ever since. Neurologic data of importance are: absence of light reflex in right pupil, inequality of pupil, paresis of right facial, increase of deep reflexes. The general physical state is entirely negative, the patient being in excellent condition in every way. Both the blood and fluid show negative Wassermann to all antigens. Cell count could not be determined on account of blood contamination. Such positive neurologic findings as are present are the meningeal residuals that are the permanent traces of the reaction of the nervous system to a miningeal infection. The mental defect is a progressive dementia due to cortical degeneration following injury to the cells of the cortex and their adventitious structures. There is very likely no active process going on at the present time, but a steady degenerative reaction due to nutritional disturbances in the cells. The contrast between the preceding case and this one is evident. The lack of meningeal participation is evidenced by the normal spinal fluid as far as globulin is

concerned, though it would be more definitely proved if a cell count could have been made. The mental age of this man as estimated by the intelligence scale point test is somewhat over eleven years; an average of sixty-eight is obtained. Remote memory is almost obliterated and there is marked association difficulty. Memory defect is pronounced, but some of this is undoubtedly due to attention difficulty. There is definite lessening of judgment, especially in the higher tests. Performance tests show less deviation from the normal than would be gathered from his social history. They are, however, widely at variance from those found in paresis. Certainly markedly different from those in the case of paresis which has just been presented. Here, then, is a condition of dementia or mental deterioration following an organic infectious disease which so changes an individual that his social and economic life are seriously interferred with, but not so profoundly altered as to require his social obliteration through custodial agencies. In other words, through an adaptative regulation of his life in respect both to his home and his work surroundings he can manage to live on a lowered level of activity, it is true, but with sufficient active contact with the world as to be of use both to himself and to those about him. It is the consideration of this social, personal, and economic change as compared to his premeningitic state that the therapy of this case lies. An effort must be made to encourage him to accept the minor instead of the major fulfilments of his possibilities as an active personality in business and domestic and other relations.

CASE III.—FRONTAL LOBE TUMOR

The two preceding cases showed mental symptoms and neurologic abnormalities due to wide-spread cerebral processes involving the whole cortical surface and producing such general changes that would be covered by the descriptive term "dementia" or "deterioration." Now we have a more intricate matter to consider which has to do with the question of a localization of cerebral functions and a special reaction formula of the brain to a process located in one part of the brain, but affecting

the whole of it through the mechanism of increased intracranial pressure. The mental state presented by this patient must be analyzed through the deviations of certain functions of consciousness which are regarded as being in a sense the reactions of a certain part of the brain and of no other. Emotion, memory, judgment, and discrimination are here primarily affected and result from a process located in the frontal lobe where such items in the totality of consciousness are found best represented. It must not be regarded for a moment that psychical localization has progressed as far as this or that any such narrow notion of special cortical function can be held, but repeated experience has shown that lesions in the frontal lobe anterior to the motor cortex produce mental disturbance of a more or less characteristic type, and that for that reason something is found there that points to a special elaboration of these functions in that area. There is persumably in the frontal lobe some mechanism by which many of the higher psychic functions are, so to speak, fused, as if the stream of consciousness narrowed in this place and became its most important reaction formula. I trust that I have made it clear that I am speaking figuratively, and by drawing a crude comparison to a stream I am trying to show how a function of consciousness may be more violently disturbed by a lesion in one place than in another. The frontal lobe may be taken to represent such a place.

This patient, a married woman of forty, was brought to the hospital from a neighboring town in a ambulance. She was unable to walk and complained chiefly of a dull headache, loss of memory, and great weakness. Her husband reported that in the past few months she had changed a great deal; that she had become emotional, irritable, excitable, with frequent variations of mood. All these were foreign to her make-up before her present illness.

There are no important items in regard to her past or family history and no important fact in inheritance that would have any influence upon her present condition. About one and a half years ago, without any definite cause, the patient began to have attacks of headache and vertigo, resulting in disturbance of gait

and difficulty in maintaining an upright position. These were at first only present when the headache was severe, and always accompanied them. There were periods in which she would fall, not to one side or the other, but in a sort of a squatting position. Ten days ago she had to remain in bed on account of her inability to stand upright. Since that time she has been bed-ridden, though the headaches have not always been present. The relation between headache and the inability to maintain the upright position is, therefore, not a close one any longer. The memory defect came on gradually, so that the patient was only aware of it when tested by questioning. On entrance a state of euphoria was noted, which at times became almost one of exaltation, particularly so when some religious association was brought up either in the course of the conversation or from some idea originated by herself. Occasional attacks of depression were also noted during which the patient would weep and become distressed and accuse herself of carelessness. Very often these attacks would seem to have a logical cause, for example, bed-wetting or some other disturbing incident of her hospital life. In the matter of the suggested operation she would react in this manner, becoming very excited and demonstrative, insisting that she was perfectly well and that she wanted to leave the hospital. In such states she would completely ignore the fact that she could not walk and that she was obviously unfitted to resume her former active life. At times she would approach a semimaniac state without the usual motor components to this condition. A total lack of insight into her condition was one of the most characteristic features. Intelligence tests showed a mental age of close to twelve years, a total of seventy-four. There was a definite scattering in the tests. Tests for recent events showed little defect, but for remote happenings there is almost total deficiency. There is a definite judgment loss. In all these tests there is a striking emotional reaction, an irritability in striking contrast to the state of euphoria described in the entrance note. There is a definite dissociation of ideas at times almost reaching that of ideation flight.

The curious mental state presented by this patient on analysis

is suggestive of a change in personality depending upon the alteration and the replacement of certain psychic attributes which are the expression of the individuality and which arise from the orderly workings of selective cortical functions. Whether all of these attributes have their origin in the frontal lobe is, of course, exceedingly doubtful, but that a certain degree of integration is there put in play there cannot be much doubt. At any rate, a lesion in this region or its neighborhood is seen to produce the most immediate change in the former attributes of personality, the alterations often being of the reverse order of psychic qualities. It must be remembered that we are taking into account the influence of a lesion localized and circumscribed, so that its effect must be direct and not the result of wide-spread processes that were present in the two former cases. Cerebral tumors in other regions capable of producing a great amount of intracerebral pressure, even more than was probably present in this case, do not produce the remarkable alteration in personal qualities that is seen here. Memory weakness, mood alterations, irritability, expansiveness, exaltation, defective association processes, and defective discrimination make up the sum of the mental deficit. Of these, the memory defect and the corresponding lessening of the faculties of attention and concentration, with the illogic state of euphoria, form the outline of the abnormal psychic scheme presented by this patient. Associated with the mental symptoms were a great number of other findings, pointing to the existence of a cerebral neoplasm and suggestive of its localization in the frontal lobe. The existence of headache, vomiting, vertigo, and the gait and postural defects that have been mentioned pointed to a process causing increase of cerebral pressure. The optic disks showed enormous choking, the swelling amounting to 7 diopters with hemorrhages in the retina. To indicate the side of the lesion there were pertinent facts pointing to the left. These were right-sided lower facial paresis of the central type, weakness in the right arm and leg, with a history of an attack or attacks in which their failing power became more pronounced and the occurrence of a Babinski reflex on that side. Another group of symptoms is of interest in this scheme of local-

ization. These happen to be of little value here on account of the mental state which has been alluded to. This has reference to disturbances in the sphere of taste and smell. Many tests had to be made to determine the existence of these anomalies, and in the end the findings were still too illusive to illustrate the difficulties often met with in the examinations of the functions of the special senses. First of all, there was a pointed history of the existence of subjective olfactory sensations antedating the gross pressure symptoms by many months. In the special tests to determine the ability of the patient to differentiate various substances a variety of results were obtained by the different examiners. At times the patient seemed to be unable not only to discriminate between various substances commonly used in such tests but also to have lost the perceptive reaction to smell stimuli. The same anomaly was found to be true in the tests for taste. While the conclusions in respect to taste and smell were doubtful, yet there was no question concerning the existence of some defect in the discriminatory function of the olfactory perceptive center, which, as you know, is situated in the hippocampal gyrus at the inner tip of the frontal lobe, a position well within the direct effect of a tumor at the frontal lobe at its base. The absence of speech defects of any sort was at first puzzling because the center of motor speech at the lower end of the third frontal convolution was in the zone of the tumor process. The speech center, as you know, presides over a singularly delicate piece of mechanism, and is most easily disturbed in its accurate workings by even slight lesions in its neighborhood. This patient, however, was ambidextrous and often made use of her left hand in writing and in the performance of delicate and finely co-ordinated movements, so that the left-sided localization of the tumor could still be supported. The blood gave a negative Wassermann, the spinal fluid was not examined for the reason that a suspected basal tumor might occupy the posterior fossa, in which case this procedure is apt to produce serious disturbances. In this case the information to be obtained from the examination of the fluid did not warrant exposing the patient to this danger. All other causes of increase

of cerebral tension were successfully excluded by the data obtained in the general physical examination and by the usual laboratory tests. The patient was, therefore, transferred to the surgical service, with the diagnosis of cerebral neoplasm located in the left frontal lobe forward at its base. The operation certified a tumor in this region, an endothelioma, which was removed. The patient died, however, seven hours after the operation from postoperative edema. In this case, therefore, there results a group of mental symptoms giving the picture of a psychosis in an individual with a tumor in the frontal lobe producing by virtue of its local effect mental reactions analogous in many ways to those seen in the preceding cases where no local process exists.

CASE IV.—DEMENTIA PRÆCOX

I propose now to demonstrate by means of clinical contrast 2 cases of psychic disease in which as far as can be ascertained no definite pathologic changes in the brain exists which can in any way be connected with the display of symptoms that are found. I have chosen a type of mental reaction in which emotional abnormality is its most evident clinical characteristic, and one in which there is a curious splitting of personal consciousness, to which the term "dementia præcox" is given. Both these cases are supposed to be the result of psychogenic agencies; that is, the mental abnormalities are not the result of gross changes in the structure of the brain, but due to abnormalities in the proper functioning of consciousness. In neither instance is an etiologic factor present which can be regarded as of prime importance except that rather nebulous one of inheritance, and here, as it happens, not even this traditional cause can with any degree of certainty be proved. That there is probably something inherently wrong in the nervous system of both these individuals is very evident, but just what that is and to what it is due is entirely unknown at the present time.

This case of dementia præcox has an added interest because his elder brother is at the city sanitarium with the same diagnosis.

The patient is a musician twenty-six years old. He has been depressed and melancholy, according to the report of the mother, for over a year. She thinks he has been this way ever since his brother was sent to the city asylum, which is about a year ago. Occasionally the depression has been interrupted by outbursts of anger and rage, chiefly incidental to some fancied experience, remark, or action of those about him or those with whom he comes in contact—such as the people living in the flat above and other neighbors. There have been no marked conduct deviations requiring custodial care. The family history gives no definite data as far as the present illness is concerned. Both father and mother are living and well. The one brother, as I have said, is at present an inmate of the city sanitarium with a diagnosis of dementia præcox. As far as can be learned there is no other instance in the family or its connections of any case of mental disease. The mother appears to be sufficiently normal, but has cultural strivings in the matter of education for her son and herself that are not sympathetic to her husband. I have not met the father, but from the description he seems to be a hard-working traveling salesman, seldom at home, and not at all interested in the musical tendencies shown by his sons. Evidently his ideas in regard to his children were in line with traits which he himself possesses and which should have directed them into more practical and profitable channels than that of music. The father also appears to possess some strange views in regard to medicine, chiefly that physicians and medical investigation are useless. Fresh air, lots of food, and work are the things that he thinks should cure any illness, and particularly the sort to which his two sons have fallen victims. There is, therefore, found in the father's attitude to the son a source of conflict which has no doubt existed as long as the tendencies of his children have shown a departure from the conventional business and practical standards. The mother is a frank, simple sort of woman, treasuring highly the artistic qualities of her sons and seeing in their development proof that she and they are superior intellectually and spiritually to the husband. Presumably both boys grew up in an atmosphere that reflected this antagonism

of views and were constantly reminded of the superior type of minds that they possessed. The expectations that were aroused by their evident musical talent as children were not realized, as neither of them advanced much beyond a routine proficiency, and both became teachers of music and filled minor positions in church choirs or theatre orchestras.

The past history of this patient gives no etiologic factor of importance in the development of his present condition. He had many of the infectious diseases of infancy and childhood, an acute middle-ear infection being the most serious. Nine months ago he went through an influenza which left him pretty weak. This boy grew up different from most boys—he was not fond of outdoors, did not play games, and had few associates. He was always shy, reserved, and fearful in the presence of people. He and his brother have been close companions and pursued their musical studies together, sharing a common ideal. Two years ago the brother developed symptoms of mental disease for which he had to be sent to a sanitarium. This patient took his place at a dry goods store where he had obtained temporary employment. Here he was made fun of and jeered on account of his awkwardness and because his brother had become insane. He soon left this place and attempted to keep on with the position of organist at a church which he had held for some time. He found that he could not do this, and since then has done nothing at all. Owing to the insistence of the father, the brother was taken away from the sanitarium and sent to a health farm. The patient accompanied him and spent a number of months with his dementia præcox brother, who had to be sent back to the asylum because of persecutory ideas and the conduct anomalies that result. Since that time this patient has developed on his own hook many of the symptoms of the same disease.

When this patient entered the hospital he was depressed, saddened, with slow and deliberate movements, speaking in a slow, rather indistinct, toneless voice. He answered questions, but showed no speech initiative and no desire to prolong conversation. It was noted that he was very precise in his movements and attitudes, and that when once assumed they changed

only after long intervals. Sitting in this fixed position with his hands spread out on his knees, the feet placed carefully parallel to each other, and with a fixed, rigid expression on his face he presented an appearance characteristic of the præcox psychosis. During the whole of his stay at the hospital the tendency to stereotyped movements, expressions, and attituded and fixed positions approaching that of katatonia were present. The melancholy facial expression and the conventional smile, the tendency to grimaces, and the impossibility of personal approach made up a clinical picture that cannot soon be forgotten. There is no definite deterioration; memory and attention are well preserved; answers to questions, while slow, are correct and intelligent. The impression he gives is that behind the screen of impassivity and indifference there plays the elements of a vivid and alert mental life hidden from the inquirer and utterly at discordance with the external aspect of the individual. There is seen at times a contradictory mood variability and an emotional background dissociated entirely from the reality of the patient's environmental contact. This dissociation of emotion with event is strikingly shown when in attempts at conversation the patient smiles when telling of his utter hopelessness and inadequacy, and of his chief complaint, which is a feeling of incapacity and a sense of physical incompetence. The introversion of the patient is almost complete, the outside world seems for him to scarcely exist, and he appears to be firmly gripped by some internal ideational structure so far superior to the daily and commonplace happenings of the world about him that it is scarcely worth his attention. In this condition he feels a sense of superiority and aloofness which colors his personality, giving it a far-off, shut-in quality.

The mental examination bears out many of the observations made in the course of the ward routine. It is found that his mental age is very high. There is a very slight memory and association defect, suggestibility is increased. His manner is katatonic, judgment is not affected, though attention is sometimes difficult to obtain. He is markedly indifferent regarding the tests as something rather beneath his intelligence. Yet,

he is a good subject—obedient and co-operative within the limits that he himself sets. Beyond this he refuses to go. There is not the slightest hint of real mental deterioration, but there is a complete absence of adjustability and a complete lack of social responsibility. The occupational therapeutist notes that he has a complete lack of initiative and a loss of sustained interest. She describes a condition of mental drifting. This well describes his behavior in the ward.

The neurologic examination is, in the main, negative. The *x*-ray plate of the skull shows no anomalies. There is a definite atonic condition of his vasomotor system, hands are cold and somewhat cyanotic, pulse is slow, with a low systolic blood-pressure. The adrenalin test is negative, and the blood-sugar is .0620—16–12, a curve that is characteristic of moderate states of anxiousness. The most positive finding is a stationary but definitely outlined chronic tuberculosis limited to both apices and shown clearly in a 7-foot plate.

Here, then, there is a typical picture of a beginning dementia præcox of the katatonic type in which the dementing process has not shown the slightest degree of advance and in which the etiologic factors can be traced in the habits and customs that have surrounded this patient ever since the sense of self-awareness has manifested itself. The initial conflict sources, some of which have been mentioned, prolonged themselves in his adult life, and have there become fixed and then diverted to the mannerisms and to the conduct deviations that you have seen. The experiences with the brother have no doubt been an important fact in the production of his mental state, but the imitative influence of this experience would not have registered their complete effect unless the soil had been prepared by the habit reactions of his earlier years. The factor of tuberculosis must be regarded as an intensifying mechanism, which, through the element of bodily fatigue due to the playing out of resistance, produced the best possible state of receptivity to the grip of the abnormal psychic mechanism that has just been outlined.

CASE V.—MANIC-DEPRESSIVE PSYCHOSIS

The last case, a woman of forty, married, with 3 children, presents a mental condition that differs in many essential ways from the cases that have previously been shown. In the other cases the outstanding mental abnormalities were primary defects of intelligence, the emotional elements playing a secondary place. Here the emotional reactions are the primary factors, while the intelligence shows only the natural slowing down due to mood variations, lack of interest and concern. This is a case of manic-depressive insanity, so called because the primary change is found in the affect variability connotated by these terms. The clinical picture is complex in response to the innate deviations in the emotional life—at one time the reaction is expansive, exalted, with motor restlessness, quickening of intellectual process, rapid association, speech overflowing, and conduct uncontrolled, impulsive, and illogic. This is followed by the reverse state, in which the mood is depressed, motor response below normal, thought retarded, environmental reaction almost completely absent, and attempts at self-destruction common. A combination of these two is common. There is a characteristic recurrence and periodicity to this disease which is seen in this patient. This is the second or third attack. There are no important facts in the past or family history worthy of mention. She has always been a diligent and hard-working mother, living in a narrow range of domestic interests. She has been an important factor in the present success of her husband, a vigorous type of business man, who from small beginnings has advanced to the ownership of a prosperous business. He has always confided his business affairs to her, but with their growing scope and importance she has evidently not been able to keep pace. She fears constantly that he is handling too large an undertaking and his reference to sums of money that are required seems to terrify her. She cannot follow him into the intricate situations of business and finance with which he has become at home. With his success her doubts and distrust for the future increase. The present attack seems to be related to one of his business ventures in which he sold his house at a large profit.

This was built some years ago at the beginning of his success, and long regarded by her with pride as a model and complete home. Although they continue to reside in it under favorable leasing terms, she cannot escape the feeling that their home is no longer their own and that they are without a place that can be called so. Whether this occurrence is the real cause of the present attack or not, it is so given by the patient, and in that belief it forms the rallying point around which many of her symptoms appear to collect. It is for that reason that she feels she can no longer live there and wants to be taken to another place augmenting the feeling of isolation of which she complains so bitterly. The present illness is of about five months' duration, beginning about the time of the house episode. Since that time the patient has steadily become more depressed, apathetic, anxious and hopeless, there is difficulty in sleeping, and almost no appetite. There has been some loss of weight and a good deal of diminution in muscular strength. The general appearance, as you see, suggests an individual who has declined in her general physical condition with malnutrition and physical weakness as prominent signs. Before entering the Barnes Hospital she was taken to a private sanitarium in the neighborhood of St. Louis, remaining there five days. The presence of other patients with obvious mental diseases and an unfortunate conversation with a nurse who was tactless and unintelligent made her leave. Her depression markedly increased and the belief in the hopelessness of her condition became more profound than ever.

The physical examination on entrance was almost entirely negative, pallor and the general states of malnutrition depended upon no organic processes as far as physical findings went. There is some slight enlargement of the thyroid gland, but not more than is commonly found in a woman of this age. On account of the history of four induced abortions a gynecologic examination was made, but with negative results. Neurologic examination is entirely negative. There is, therefore, nothing found in the physical examination that seems to bear any causal relation to the emotional abnormality present. As in the preceding case, this relation must be found in the study of habit tenden-

cies or trends, together with some defect in the make-up of the individual by which the various social and other conflicts impinge upon a less than normally resistant personality. The reaction is reduced to a lower level in which instincts, especially that of fear, prevail. The emotional deviations as well as the conduct anomalies may in this way be somewhat accounted for. The course in the hospital followed mainly that of an intense mood variability in which the depressive type predominated. At times there was some expansiveness with traces of acute excitement. On October 6th it was noted that she was in a much more cheerful frame of mind, spoke in a joking way about her symptoms, and was a little inclined to be jocular. The next morning while waiting in the hydrotherapy department she became noisy, excited, and talked rapidly in a rather confused way, and refused treatment. This attack, or alteration in her previously depressed state, was followed by a period in which she actively hallucinated. She heard all sorts of sounds, some threatening in character. This again was followed by a period in which sounds were greatly exaggerated. The acoustic hyperesthesia became so marked that she would sit with her hands pressed to her ears to keep out the slightest hospital noise. One afternoon the patient insisted that she heard pistol shots, and was found standing in her room very much frightened, with the furniture piled up about her as if for protection. There gradually took place a lessening of depression with, however, an intensification of the hopelessness of her outlook and a complete indifference to living. There was a definite fear of insanity out of which she would attempt a rationalization by repeating, "I can learn things easily, I can remember things, etc." Her appetite was always very poor while at the hospital and sleep was especially difficult. Her lack of desire for food was not due to a delusion of poison and there was never a trace of persecution in her ideas relating to her present misfortune. She was allowed to leave the hospital and her husband was warned of the constant danger of suicide. About one week later she was brought back to the ward with a history of having attempted to push a hairpin into her throat just above the thyroid cartilage. No important damage was done,

though she was for a few days afraid of blood-poisoning. From that time she has slowly but steadily improved, and the last note on the 28th of October is to the effect that she is better, has gained about 7 pounds in weight, and confesses to a more natural state of mind. She is doing some work about the house, is living at home, and finding it possible to resume in a measure, at least, some of her former activities. Although she is still somewhat depressed and still under the influence of the ideas that originated from the house episode, she is less inclined to be dominated by them. This, in brief, outlines the history of a recurrent depression lasting five months or more in an individual who has evidently developed, from what source it is not known, the tendency to periodic reactions of this sort in answer to conflict experiences in her life arising out of the particular environment in which she lives. The intellectual features of these states are all of them secondary to the mood variations and are not sufficiently pronounced or deep seated enough to produce mental deterioration. The delusions, if present, all have reference to herself and arise out of the contemplation of her condition. The self-destruction impulses are the logical results of what she believes to be her physical and mental state, and arise out of the hopeless situation that she believes she has fallen into.

Treatment in this case has been planned upon very simple lines. General nutrition, rest, and protection against suicidal impulses. Such alterations as are possible in the attitude of those about her with such corrections of the surroundings as can be made. She was encouraged to take up her duties and to do some work, and the therapeutic advantage of this was explained and repeatedly gone over. Her condition was made the subject of many simple talks, and such of its physiology and psychology as she could appreciate was gone into again and again. It is found effective in these cases to use the simplest expressions and to repeat them in almost the same words.

The cases that have been shown in this clinic have been but briefly presented; the outline of each case was planned to give only the barest sketch of the story in each instance, yet these 5 cases are of some interest not only because they are taken

bodily out of the neurologic material in a general hospital, but because they represent fairly well the every-day problems of mental illness as they occur and recur in the experience of any practitioner of medicine. I hope that you will appreciate and take with you from this demonstration the idea that in every case of insanity there is a stage in which the clinical problem presented is one that can be approached from the standpoint of a medical problem, and that the longer in the course of a mental disease this approach can be kept up the greater the therapeutic advantage of the patient will be.